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ABSTRACT

This kit is designed to help science and mathematics teachers become more aware of the rights, responsibilities, potential contribution, and needs of students with disabilities, teachers' responsibilities for ensuring equal educational opportunities for all students in their programs, and strategies for accommodating students who have disabilities in science and math classes. Material includes a notebook, a 2-hour videotape recording, and informational handouts and a pamphlet on the DO-IT (Disabilities Opportunities Internetworking Technology) program. The "Background and General Strategies" section of the notebook covers general issues related to access to education for individuals with disabilities, and legal and attitudinal issues as well as general teaching strategies. The "Computing Access" section covers the three areas that must be addressed in order to provide full access to computing resources (computer lab access, provision of adaptive technology, and universal design of electronic resources). The "Access to Math and Science" section provides strategies and examples for making educational activities accessible to all students, including students with disabilities. A list of general resources and a glossary on disability issues relevant to science and mathematics instruction are also included, along with reproducible handouts and overhead transparency templates. The videotape demonstrates how technology can be used to make instruction accessible. (CR)

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ED 444 305

DO·IT

Accommodating Students with Disabilities in Math and Science Classes

A RESOURCE FOR TEACHERS

Sheryl Burgstahler, Ph.D.
Steve Nourse, Ed.D.

Disabilities
Opportunities
Internetworking
Technology

EC 307995

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Accommodating Students with Disabilities in Math and Science Classes

A RESOURCE FOR TEACHERS

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Developing the DO-IT MATH-SCI project and creating these instructional materials so that others can learn from our efforts have resulted from the work of many. Our project development team that helped create these materials included Imke Durre, Kathy Medcalf-Flaker, Jeanne Portelance, Alan Roth, and Cheryl Smith. Special recognition for their contributions goes to Pat Cashman, Charlie Hinckley, Kurt Johnson, Mick Moore, and Amy Olson. Thanks also goes to David Kennedy, Peggy Vatter, Mary Jo Johnson, and Karen Freedel for their support.

A special thanks goes to the DO-IT Scholars, Pals, and Mentors who have taught us many times over to look at the unique abilities of every student. In the course of developing these materials we asked them to share with science and math teachers ideas for working with students like themselves. Here are a few suggestions from the real experts.

- My name is Nhi. I attended high school in Washington. I am visually impaired and have limited vision in seeing details. One thing I would suggest is that the teacher describe in detail what is happening in a science lab. For instance, in a physics lab, have the student feel with their hand (if it is possible). An example would be, when we do an experiment on using the pulley and putting weight on it to make a cart on a table accelerate, it would be nice if the student like me can feel the process and have it described in detail to them. Or in biology, when it comes to dissecting a frog, have a blind student do the dissecting with guidance from a visual student on what and where to dissect.

- My name is Sue and I am from New York. I have mild CP, ataxia and neurological impairments with perceptual problems and my motor coordination is very limited. When I took biology, my lab partners did the dissection while I wrote up the labs. To make it more accessible, we swapped duties. In college science classes, I had additional physical assistance with manual projects and extra time on tests and assignments.

- My name is Josh. I attend high school in Iowa. My disability is spinal muscular atrophy and I cannot walk and have limited use of my arms. One thing I suggest to math and science teachers with a student with a disability like mine is to make sure all lab areas are at the right height and lab items are within reach.

- My name is Bridget McCarthy. I attended high school in Washington and I'm currently a college student. I'm profoundly hearing impaired and my main problem is understanding speakers. When presenting a topic or giving instructions for an activity, visual aids, especially written comments or instructions, are very helpful. I also use a microphone system with the speaker, called an FM system. Be aware that hearing impaired students may not hear random and quick comments you may make during an activity. Speakers need to have the attention of everybody, including the hearing impaired student, before saying anything important.

- My name is Trent. I attend high school in Washington State. My disabilities are having seizures and coordination difficulties. Because of these disabilities I miss important parts of lectures at times and am unable to write or type fast enough to take notes. Doing math is difficult because there is not enough space on most tests for my large handwriting. The accommodations that have worked for me are getting extra time to take tests, providing enlarged test paper to write answers on, and allowing me to tape record lectures to listen to at home. It is also helpful for me to have a lab partner to assist in making precise measurements and writing the experiment results.

- My name is Frank. I have been blind since I was 16. I attended high school in Helena, Montana. I am currently an electrical engineer for Battelle Laboratories. Math and science can be difficult subjects for a blind student – not only because of the visual nature of graphs and much of the lab work but also because of the "rush rush" nature of most classroom labs. Be sensitive to the need for preparation time required by the student before the class commences to get textbooks recorded onto tape or put into Braille. The many new adaptive technologies now available to help deal with the barriers imposed by blindness are wonderful but nothing can replace the mentoring and support of the teacher who is aware, positive, and proactive. Working with a student who is blind is neither a burden nor a blessing, just another challenge. Your attitude and the choices you make can be pivotal. Most important, remember that you need to work closely with the student as a partner in this process, letting him or her participate in the development of the approaches and accommodations that you will incorporate into your lessons. Every blind person is an individual and is usually the most knowledgeable resource on what specific adaptations work best for them.

Frank's success in pursuing a career in this field demonstrates that people with disabilities can DO-IT!

ABOUT THE AUTHORS

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Dr. Burgstahler is Assistant Director of Information Systems, Computing & Communications, and Adjunct Associate Professor in the College of Education at the University of Washington. She has taught mathematics, computer science, and Internet courses at the pre-college and college levels. Dr. Burgstahler currently directs project DO-IT (Disabilities, Opportunities, Internetworking and Technology), which helps students with disabilities succeed in academic programs and careers in challenging fields such as science, engineering, and mathematics. She has published articles and delivered presentations at national and international conferences in the areas of distance learning, electronic communities, increasing the representation of people with disabilities in science and mathematics programs, adaptive technology, and use of the Internet to enhance learning. Dr. Burgstahler is the author of the books *New Kids on the Net: A Tutorial for Teachers, Parents and Students*, *New Kids on the Net: A NetWork Sampler*, and *New Kids on the Net: Internet Activities for Young Learners*. She has co-authored three books with content-area specialists – *New Kids on the Net: Internet Activities in Secondary Mathematics*, *New Kids on the Net: Internet Activities in Secondary Science*, and *New Kids on the Net: Internet Activities in Elementary Language Arts*.

Steven Nourse, Ed. D.
Dr. Nourse has been an elementary, middle and high school teacher and has taught graduate and undergraduate special education courses at the university level. He worked on Washington's five-year systems change grant in transition services and on various projects. He has worked as an Equal Opportunity Specialist with the U.S. Department of Education. While there he investigated race, sex, and age, disability discrimination and sexual harassment cases trained educational administrators regarding these issues. He holds a BA in Special Education from Central Washington University and an MSW, specializing in physical disabilities and a doctorate in Special Education from the University of Washington. Most recently he co-authored *What follow-up studies say about post-school life for young men and women with learning disabilities: A critical look at the literature*, published in the Spring, 1998, Journal of Learning Disabilities and a chapter titled *Moving from School to Adult Life: Transition Services for Students with Disabilities* in the textbook Physical Medicine and Rehabilitation Clinics of North America. Dr. Nourse produced a series of 26 videotapes titled *Special Education 101 for Paraeducators* for the Bates Technical College Paraeducator Training Program. Dr. Nourse is married, has two daughters, and is a person of disability.

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FOREWORD

The number of individuals with disabilities seeking post-secondary education has increased three-fold over the last decade. However, people with disabilities are still under-represented in many academic and career areas, including science, engineering, and mathematics. Recent advancements in adaptive computer technology, greater reliance on computers in these fields, and increased job specialization have resulted in career opportunities that were once considered unattainable for individuals who have disabilities. Many require knowledge and skills obtained through post-secondary education.

Negative attitudes are reported as the single most significant factor faced by individuals with disabilities pursuing math and science careers. Other barriers include lack of access to facilities, inadequate academic preparation, and low teacher expectations. To reduce these barriers, the University of Washington has implemented the MATH-SCI project as part of project DO-IT (Disabilities, Opportunities, Internetworking, and Technology). MATH-SCI stands for *Making Accommodations that Help Schools Create Inclusion.*

Federal legislation mandates that, when needed, academic accommodations be made to ensure that students with disabilities receive appropriate educational opportunities. Studies show that educators who have had interactions with students with disabilities generally have more positive attitudes about working with these students. Further, those who are familiar with accommodation strategies are better prepared to make arrangements which will ensure that students with disabilities have equal opportunities to participate in their programs.

The purpose of the enclosed videotape and written materials is to help science and math teachers become more aware of:

- the rights, responsibilities, potential contributions, and needs of students with disabilities;
- rights and irresponsibilities for ensuring equal educational opportunities for all students in their programs;
- strategies for accommodating students who have disabilities in science and math classes; and resources.

Funding for the production and distribution of the enclosed materials was provided by an Eisenhower Foundation Grant, the Telecommunications Funding Partnership, US West Communications, and the National Science Foundation. We hope that you find these materials useful in your efforts to ensure that all students in your programs have equal opportunities to learn, explore interests, and express ideas.

Sheryl Burgstahler, Ph.D.
Director, DO-IT

Steve Nourse, Ed.D.
Project Coordinator, DO-IT MATH-SCI

University of Washington
College of Education
College of Engineering
Computing & Communications

HOW TO USE THESE MATERIALS

The purpose of this notebook is to provide science, mathematics, and special education teachers with training regarding general strategies for working with students with disabilities. Information provided includes an overview of key issues; how to make physical adaptations to classrooms and labs for general access and safety; information on adaptive technology; how to design accessible electronic resources; sample Student Abilities Profiles; and resources. Our goal is for all students to be fully included in science and math programs and, as a result, have increased career options in related fields.

The materials in this notebook can be used for individual study by science, mathematics, and special education teachers. The packet can be included with materials in a school curriculum library. They are also ideal for developing a presentation to deliver as a pre-conference workshop, conference presentation, or teacher workshop or a presentation for your school or district. The handouts, videotape presentations, and other materials are appropriate for meetings of:

- administrators,
- science teachers,
- math teachers,
- teaching assistants and lab volunteers,
- computer systems and lab staff,
- parents, and
- community service organizations.

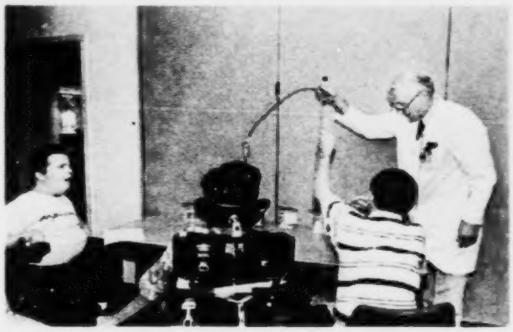
To get started in planning a presentation, designate one or two presenters to review these materials, choose the format that best fits your needs, schedule a presentation, publicize the program, and DO-IT!

The first step in preparing a presentation is to determine the appropriate purpose based on the needs of your audience. The materials in this packet can be used to deliver presentations that can help science and mathematics educators:

- become more aware of the issues, needs and concerns of people with disabilities in accessing science and mathematics;
- develop school electronic services accessible to a wide range of users by applying universal design principles;
- understand the primary types of adaptive technology and their implications for students with disabilities;
- plan and implement adaptive technology capabilities for your school computer lab or library workstations;
- learn universal design principles for developing World Wide Web and other electronic resources;
- learn about the rights, responsibilities, potential contributions, and needs of students with disabilities;
- learn strategies for working with students who have disabilities; and/or
- learn about resources available to assist in the provision of appropriate academic accommodations to students with disabilities.

A presentation can be adapted to the needs of your audience. Simply play one of the videotape presentations and distribute related handouts during a meeting. Or, use videotape materials for a day-long or multi-day workshop. Or, prepare something in between. Following are descriptions of several presentation options:

- Deliver a 15-minute presentation at a teacher meeting to share information about these materials and their inclusion in the school curriculum library.



- Develop a 30-minute presentation for teachers and other staff to give them a conceptual understanding of what adaptive technology is and how it helps people with disabilities access the Internet and other useful resources. Share the *Working Together: People with Disabilities and Computer Technology* videotape presentation and distribute the handouts titled *Working Together: People with Disabilities and Computer Technology* and *Meet the Speakers in the Videotape — Working Together: People with Disabilities and Computer Technology.*

- Develop a 45-minute presentation for teachers and students working on the school Web site. Share tips for making the Web pages accessible to people with disabilities. Show the *World Wide Access* videotape presentation and distribute the handouts titled *World Wide Access: Accessible Web Design* and *Meet the Speakers in the Videotape — World Wide Access.*

- Deliver a two-hour presentation to discuss computer lab access, adaptive technology, and accessible Web page design. Provide the tools for participants to begin including these techniques in the school's computer lab. Show the three related videotape presentations, distribute appropriate handouts, and explore in more detail the principles utilizing the overhead templates and/or electronic presentation.

- Offer science, mathematics, and special education teachers a full-day workshop to explore how science and math classes can be made accessible to students with disabilities. Include a panel of students with disabilities. Plan a follow-up meeting to discuss teacher progress and experiences in making their activities more accessible to students with disabilities. In addition to using the videotape presentations and handouts included in this binder, visit DO-IT's World Wide Web site and consider including some of DO-IT's many other publications and videotapes. Explore the organizations, books and Web sites listed in the *Resources* section and links to DO-IT's page for additional ideas and information.

To prepare for a presentation or workshop:

- Preview the videotape presentations and study the handouts, glossary, resource lists, and other materials.
- Determine presentation purpose, content, audience, and length.
- Select the presenter(s) and meet to plan the program.
- Arrange for a meeting space.
- Publicize the program.
- Arrange for a VHS VCR and monitor.
- Arrange for additional equipment as needed. This may include:
  - — overhead projector and screen
  - — microphone system
  - — computer with projection system
  - — Internet connection
  - — pointer device
- Photocopy the overhead transparency templates onto transparency film.
- Photocopy the handout templates and collate the handout packets for your expected audience.
- If you desire feedback from your audience, create an evaluation instrument and photocopy.

Now you are all set to DO-IT!

ABOUT DO-IT

DO-IT serves to increase the success of people with disabilities, especially in fields where they have been underrepresented such as science, engineering, and mathematics. DO-IT uses technology to maximize the independence, productivity, and participation of students with disabilities in academic programs and careers.

DO-IT activities help individuals with disabilities successfully:

- use computers, adaptive technology, and the Internet for academics and careers;
- pursue challenging fields such as science, engineering, mathematics, and technology;
- transition from high school to college, from two- to four-year colleges, from undergraduate work to advanced studies;
- transition from school to work; and
- gain access to libraries, labs, and information resources.

DO-IT's efforts have been acknowledged with many awards and honors. These include:

- receiving the National Information Infrastructure Award for its creative use of the Internet to support education;
- being honored with the 1997 Presidential Awarded for Excellence in Mentoring in Science, Mathematics, and Engineering,
- being showcased at the 1996 National Science Foundation Dynamic Partnerships invitational conference and the 1997 President's Summit on Volunteerism, and
- being honored with the 2000 Golden Apple Award.

Primary funding for DO-IT is provide by the National Science Foundation, the U.S. Department of Education, and the State of Washington. Additional grants have been received from Microsoft Mitsubishi Electric America Foundation, NEC Foundation of America, the Seattle Foundation, the Telecommunication Funding Partnership, U.S. West Communications, and Visio Corporation.

The *Background and General Strategies* section of this notebook covers general issues related to access to education for individuals with disabilities — legal and attitudinal issues as well as general teaching strategies. The *Computing Access* section covers the three areas that must be addressed in order to provide full access to computing resources – computer lab access, provision of adaptive technology, and universal design of electronic resources. The *Access to Math and Science* section provides strategies and examples for making educational activities accessible to all students, including those who have disabilities.

General Resources and a *Glossary* on disability issues relevant to science and mathematics instruction can be found in the *Resources* section of this notebook. Additional information can be found at DO-IT's World Wide Web site at *http://www.washington.edu/doit/*.

Reproducible handout and overhead transparency templates and videotape presentations are included in the *Tools* section for self-study as well as well as for use in presentations. They are described below.

Overhead Transparency Templates

Included are black and white templates that can be used as references or copied onto transparencies for use in presentations. A large number of transparencies are included to optimize custom presentation options. Pick and choose which templates work best for your audience and meeting length.

Videotape Presentations

Seven videotape presentations are included on the enclosed videotape.

- In a 9-minute videotape, *Working Together: Faculty and Students with Disabilities*, successful students with disabilities tell the viewers firsthand about techniques and accommodations that contributed to their success. They emphasize the importance of the faculty-student relationship.
- The 15-minute presentation *Opening Doors: Mentoring on the Internet* demonstrates how adult mentors can help students with disabilities achieve success in college studies and careers.
- An 11-minute videotape presentation, *Equal Access: Computer Labs*, shows how computer labs can be designed in such a way to be accessible to students with disabilities.
- A 14-minute presentation, *Working Together: People with Disabilities and Computer Technology*, introduces individuals with disabilities who demonstrate adaptive technology and computer applications for people with mobility impairments, blindness, low vision, hearing and/or speech impairments, health impairments, and learning disabilities.
- An 11-minute presentation, *World Wide Access*, introduces viewers to people with disabilities who describe the roadblocks they encounter on the World Wide Web. The videotape provides an overview of principles of

accessible Web design. Following these principles ensures that people with a broad range of abilities and disabilities are able to obtain information from Web pages.

- In a thirteen-minute presentation, *Working Together: Science Teachers and Students with Disabilities*, successful science students with disabilities suggest ways to make science activities accessible.
- In a ten-minute presentation, *The Winning Equation: Access + Attitude = Success In Math and Science*, science and math teachers share strategies for making these subject areas accessible to students with a wide range of disabilities.

Handout Templates

Black and white templates of the following DO-IT handouts can be copied for distribution to others in your school, at conferences, or during presentations. They can be found in the back pocket of this notebook.

- *Working Together: Faculty and Students with Disabilities*
- *Meet the Speakers in the Videotape — Working Together: Faculty and Students with Disabilities*
- *Opening Doors: Mentoring on the Internet*
- *Meet the Speakers in the Videotape — Opening Doors: Mentoring on the Internet*
- *Equal Access: Computer Labs*
- *Working Together: People with Disabilities and Computer Technology*
- *Meet the Speakers in the Videotape — Working Together: People with Disabilities and Computer Technology*
- *World Wide Access: Accessible Web Design*
- *Meet the Speakers in the Videotape — World Wide Access*
- *Working Together: Science Teachers and Students with Disabilities*
- *Meet the Speakers in the Videotape — Working Together: Science Teachers and Students with Disabilities*
- *The Winning Equation: Access + Attitude = Success in Math and Science*

Electronic Presentation

Materials in electronic form are available at DO-IT's World Wide Web site at *http://www.washington.edu/doit/*. Here you will find many of the materials included in this packet. With a live Internet connection, you can use DO-IT's site during a presentation. Or, you may prefer to download the files for an off-line presentation utilizing one of many browser capture programs (e.g., Browser Buddy, WebWhacker). If you choose this presentation method, be sure to have the traditional overhead transparencies ready as a backup in case of Internet connection or computer failure!

Permission is granted to reproduce printed materials and videotape presentations for non-commercial, educational purposes as long as credit is given to the source.

Videotape Presentation:

- *Working Together: Faculty and Students with Disabilities*

Handouts:

- *Working Together: Faculty and Students with Disabilities*
- *Meet the Speakers in the Videotape — Working Together: Faculty and Students with Disabilities*

How many people with disabilities are there? Let's consider some general statistics. According to surveys conducted in 1991-1992, 19.4% of Americans have a disability and 9.6% of them have a severe disability that substantially limits at least one major life activity. (*Americans With Disabilities: 1991-1992. Current Population Reports, Series P70-33; http://www.census.gov/*)

Now, let's consider some statistics in the K-12 arena by using Washington State as an example. During the 1995-1996 school year 106,666 students with disabilities aged 3 through 21, or 11% of the total school enrollment, were served in the State of Washington (*Fifth Annual Report for Special Education Services in Washington State*, December, 1997). Overall, in the State of Washington, 50% of students with disabilities are served in regular education classroom settings.

Recent advancements in adaptive computer technology, greater reliance on computers, and increased job specialization have resulted in career opportunities in fields that were once considered unsuitable for individuals with disabilities. These careers include those in science, engineering, and mathematics. Many of these careers require knowledge and skills obtained through post-secondary education.

Surveys show that the number of identified individuals with disabilities seeking post-secondary education has tripled over the last decade. Reasons cited for this increase include those visited below.

- Advances in medical technology and techniques result in greater numbers of people who survive traumatic accidents and problematic births.
- Improvements in technology make it possible for more people with disabilities to live independently and have productive lives.
- The creation of federal and state mandated pre-college academic support programs helps more students with disabilities complete high school and consider post-secondary education options.
- Publicity of federal disability-related legislation increases awareness of rights to accommodations and equal opportunities in education and employment.

The number of individuals with disabilities seeking post-secondary education has increased three-fold over the last decade. However, people with disabilities are still under-represented in some academic and career areas. These areas include science, engineering, and mathematics.

"For far too long," says Dr. Larry Scadden, Senior Program Officer for the National Science Foundation's Program For Persons with Disabilities, "we've been closing disabled people out of science and math, in the classroom, the laboratory, and the workplace. There is a vast amount of intelligent people who simply don't know how to accommodate the disabled. They don't have any idea how disabled men and women do science – they don't really realize that they can do science. In some instances, students don't want persons with disabilities in their classrooms or labs. They're afraid they'll be slowed down by them. They don't want competition for their time at the lab bench. These attitudes – the myths and the ignorance – have created a major barrier that must be removed." (*Breaking Barriers: People with Disabilities in Science and Mathematics Education*, Synergy, March 1998).

Scadden's words are supported by the results of a 1996 NSF study of students with disabilities who were pursuing majors in science or engineering fields in college. Consider the following implications of these results regarding the students surveyed.

- For 42% of the students with disabilities, it was not until college that they first developed an interest in their chosen science-related major. In comparison, only 30% of students without disabilities developed their interest in college. More typically, students without disabilities became interested in science before or during high school.
- Forty-six percent of the students with disabilities felt that high school had prepared them well for college, compared to 63% of their non-disabled peers.
- Forty-eight percent of the students with disabilities said there was someone in their scholarly life who served as a mentor compared with 60% of students without disabilities.
- The science and engineering majors with disabilities frequently reported problems in communicating with, and relating to, professors and fellow students. This finding suggests that students with disabilities may not have access to peer groups and other support networks that other students do and that there may be a general lack of awareness about disability issues on the part of students and faculty in post-secondary institutions.

Scadden – totally blind himself – alludes with great pleasure to such historical figures as Galileo, who went blind, and Einstein, who was thought to have been Dyslexic, as well as to the renowned contemporary physicist Stephen Hawking whose movement and speech are severely affected by Amyotrophic Lateral Sclerosis. Society cannot afford to deprive itself of the potential for scientific progress that resides, and all too often remains untapped, in the minds of people with disabilities.

It should be noted that society in general tends to benefit from innovations that were originally conceived to benefit people with disabilities. For example, captions on television were created for people with hearing impairments but are now used by millions of people who need to watch TV in noisy places or with the sound turned off so others are not disturbed. "Curb cuts," intended at first to help people using wheelchairs to negotiate intersections, are a welcome accommodation to the elderly, parents pushing baby strollers, bicyclists, delivery people, and skateboarders. "Generally," reports Dr. Scadden, "if you design a product – whether it's a consumer product or a classroom curriculum – in a way that it can be used by people with disabilities, it will be a better product for everybody."

The information provided in this section will help you develop general strategies for working with students with disabilities. It is organized as follows:

Access Issues

Legal Issues

General Teaching Strategies

- Low Vision
- Blindness
- Hearing and Speech Impairments
- Specific Learning Disabilities
- Mobility Impairments
- Health Impairments
- Interpersonal Interaction

Mentoring

The following article appeared in Information Technology and Disability, December, 1994, 1(4). It is reprinted with permission.

Increasing the Representation of People with Disabilities in Science, Engineering, and Mathematics

by Sheryl Burgstahler, Ph. D.
University of Washington

Abstract

There are three main factors which cause individuals with disabilities to be under-represented in science, engineering, and mathematics fields: preparation of students with disabilities; access to facilities, programs, and equipment; and acceptance by educators, employers and co-workers. Technology can have a positive affect on all of these factors and help to open doors to new areas of study and employment. This paper explores the role of information technology, describes a campus program designed to positively influence each of the factors, and makes a series of recommendations for action.

Introduction

Access to higher education can enhance the employability and vocational success of individuals with disabilities (DeLoach, 1992; Sampson, 1984). Although the number of individuals with disabilities attending post-secondary institutions is increasing, few pursue academic careers in science and engineering and, for those who do, the attrition rate is high. Individuals with disabilities are also under-represented in science and engineering professions, and scientists and engineers with disabilities experience higher unemployment rates than do other scientists and engineers (Malcom & Matyas, 1991). Nevertheless, the employment rate for scientists and engineers with physical disabilities is much higher than the estimate for the overall U.S. population with physical disabilities. These facts suggest that students with disabilities can find success in science, engineering, and mathematics fields. Recent advancements in adaptive technology provide efficient, relatively inexpensive access to computers and networks for people with a variety of disabilities (Brown, 1992; Burgstahler, 1992a). As a result, careers that exploit technology are particularly accessible to individuals with disabilities. The increased use of technology in science, engineering and mathematics combined with the increased availability of access technologies strongly suggest that the time is right to promote the inclusion of people with disabilities in science, engineering and mathematics fields.

Discussion of the Problem

Individuals with disabilities are under-represented in science, engineering, and mathematics educational programs and professions. Causes of this problem can be found in three areas: preparation of students with disabilities; access to facilities, programs, and equipment; and acceptance by educators, employers, and co-workers.

Preparation

For an individual with a disability to experience life to the fullest, independent-living and self-advocacy skills must be developed (Transition summary, 1988). As the end of high school approaches, so does the termination of a structured environment and pre-college support systems (Burns, Armistead, & Keys, 1990). Adolescents with disabilities who wish to attend college are often faced with responsibilities that they are unprepared to meet because they are conditioned to depend on others (Transition summary, 1988). Once enrolled, students with disabilities often hesitate to request the specific accommodations they need (Amsel & Fichten, 1990). The levels and types of resources available to students with disabilities in pre-college programs, on post-secondary campuses, and in employment situations are different and programs to help bridge the gaps between these critical stages are rare.

Students with disabilities are rarely encouraged to prepare for science, engineering and mathematics fields. Since they do not consider a career in science, engineering, or mathematics an achievable goal, they do not take the courses necessary to prepare for post-secondary studies in these areas. High school and college students with disabilities, counselors, social service agency staff, and special education teachers often lack an understanding of the content and requirements of science, engineering, and mathematics programs in higher education and of the technology and other resources that make it possible for students with disabilities to pursue these fields.

Students with disabilities lack access to role models with similar disabilities who are successful in careers that they might otherwise have thought impossible for themselves (Aksamit, Leuenberger, & Morris, 1987; Fonosch & Schwab, 1981). Potential role models are often separated by great distances, leaving individuals with disabilities isolated from those facing similar obstacles in school and work (Brown & Foster, 1990; Moore & Nye, 1986).

To prepare for science, engineering, and mathematics studies, students need to be able to use the powerful tools of the trade at an early age. Although network technology can reduce social isolation and allow independent access to information resources (D'Sousa, 1991), these tools are not often readily available to pre-college students with disabilities.

Access

Computers, adaptive technology, and network resources can bridge the communication and accessibility gaps for people with disabilities. Electronic communications provide new options for independent access to people and resources. Computer and network access can increase levels of independence and have a positive impact on the academic progress and career success of individuals with disabilities (Coombs, 1991; Burgstahler, 1992a; Burgstahler, 1992b; Horn, Severs, & Shell, 1988). Unfortunately, many individuals with disabilities and people in their primary support systems are unaware of the tremendous contributions technological innovations can make to the lives of individuals with disabilities. Students with disabilities are not guaranteed access to computing and networking technology in pre-college and college programs (Burgstahler, 1992a; Horn & Shell, 1990). Likewise, lab facilities are often inaccessible to students with disabilities.

Those who wish to pursue science and mathematics fields need access to publications in these fields. Scientific and mathematics publications are not readily available in alternative formats for the print-impaired. Making them available in electronic format can assist those who have adaptive technology to produce materials in alternative format, such as large print, however some barriers still exist in making mathematics and scientific symbols accessible to those who are blind. A number of approaches being explored for making materials accessible to individuals with disabilities are reported in other articles in this issue. Universal access to publications will require the creation of new products as well as promotion of the use of existing methods.

Acceptance

A National Science Foundation task force (Changing America, 1989) stated that negative attitudes are the single most significant barrier faced by individuals with disabilities pursuing careers in science and engineering. Faculty and employers lack information about the rights and needs of students with disabilities and their potential contributions to society; they often have negative attitudes about including students with disabilities in academic programs and employment. Professors are particularly reluctant to include students with learning disabilities (Leyser, 1990) and have little knowledge of the characteristics and needs of students with this type of disability (Akamit et al.; Dodd, Fischer, Hermanson, & Nelson, 1990). Faculty in science, engineering, and mathematics are less accepting than those in social sciences and education (Fonosch & Schwab, 1981). However, faculty attitudes have been found to be more positive when faculty members have previous contact and more information about students with disabilities (Aksamit et al., 1987; Fonosch & Schwab, 1981; Sedlacek & Stovall, 1983).

The Role of Information Technology

Information technology plays a key role in the three areas addressed in this paper. In order for students with disabilities to prepare for careers in science, engineering, and mathematics fields they must begin to use computing and networking tools at a young age. These tools can help them access resources, communicate with others, and perform academic tasks independently. The importance of the availability of adaptive technologies for individuals with disabilities cannot be over-estimated. Such tools are required if individuals with disabilities are to compete with their non-disabled peers. For all students and employees, the ability to perform tasks efficiently and professionally can earn the respect of educators, employers, and peers alike. The ability to control powerful technological tools can thus contribute to the acceptance of a person with a disability as an equal partner in learning and working situations.

One University's Efforts

At the University of Washington (UW), a project is working to increase the participation of individuals with disabilities in science, engineering, and mathematics programs and careers. DO-IT (Disabilities, Opportunities, Internetworking, and Technology) began in 1992 and is primarily funded by the National Science Foundation. Below, some of the DO-IT activities that address the areas of preparation, access, and acceptance are discussed.

Preparation. The DO-IT Scholars program offers students with disabilities, beginning in their Sophomore or Junior year of high school, opportunities to study science, engineering, and mathematics; experience campus living; develop self-advocacy skills; interact with mentors; and use technology to pursue academic interests.

Internetworking. DO-IT Scholars learn to use computers and the Internet to explore academic and career interests. Computer and adaptive technologies are selected for each participant; local Internet connections are established; and in-home training is provided. One Scholar who is blind reports, "Getting access to the Internet was the best thing that ever happened to me. In a way, my computer and access to the net have become my eyes to the world." A DO-IT industry partner reports, "Network communication is a liberating experience for many of these kids, since their disabilities aren't visible in their email. They have been quick to exploit the technology, both to communicate among themselves and also to explore worlds that were previously inaccessible to them." A parent points out that too often, without a special program like DO-IT, students with disabilities have "inferior and inadequate equipment and if they can get the right technology there is nothing that can stop them in what they want to do with their lives."

Mentoring. Through electronic communications and personal meetings, DO-IT Scholars are brought together with post-secondary student and career Mentors to facilitate academic, career, and personal achievements. DO-IT Mentors study and/or work in a variety of fields including computer programming, post-secondary education, statistics, physics, engineering, computer science, computer consulting, and biology. One Scholar describes mentors as people who "provide us with useful contacts in academics, career, and personal areas ... They help participants find their talents, interests, and confirm their goals." Experienced Scholars practice communication and leadership skills as peer Mentors for new Scholars. Scholars and Mentors are encouraged to reach out and help others. For example, they communicate with patients at a children's hospital through an electronic mail account established at the hospital through DO-IT. A parent reports that her son, a Scholar with attention deficit disorder, "has already passed on some of what he got to another ADD child, by taking a boy to register for high school and showing him around so he will know where things are the first day of class."

Summer Study. During live-in programs held during two consecutive summers at the University of Washington, each Scholar studies science, engineering, and mathematics by participating in lectures and labs and using computer applications and the Internet network. Subjects include oceanography; heart surgery; chemistry; virtual reality; geophysics; material sciences, civil, mechanical and electrical engineering; mathematics; biology; physics, and astronomy. Accommodations are made in each activity to ensure that all participants remain as active as possible. In the words of Scholars after attending a summer program, "I'm excited about many different careers I could go into," and, "I learned what college life is all about." A mother of one of the Scholars pointed out how the summer study program boosted her son's "belief in himself and his abilities.... This experience has changed the course of his life." Scholars learn self-advocacy skills as part of the summer curriculum. One parent reported her son's plans to "talk to the math department head about challenging the math class he has been put into ... He says it's too easy and he wants a more difficult class where he can learn something new. He is not asking for me to help. He has the courage to go and work on this on his own. Him being his own advocate has been coming, but this jump in ability is a direct result of the DO-IT experience." After observing two summer programs, a corporate partner noted, "We repeatedly hear the comment that these kids have never experienced a situation like this before - where the focus is on their abilities (rather than their disabilities) and yet everyone else has their own challenges to overcome. The combination seems to produce an almost immediate sense of community and an extremely supportive intellectual environment."

Special Projects and Events. Throughout their involvement in DO-IT, Scholars have opportunities to pursue projects of special interest, using Mentors and staff as resources. Options include collecting scientific resources, administrating systems, editing the newsletter, teaching in the summer program, and helping with other DO-IT events. DO-IT Scholars as well as other precollege and college students with disabilities and their families, teachers, counselors, and service providers are invited to participate in special events, including the UW Computer Fair booth, presentation and reception; the UW Engineering Open House; and the UW Health Sciences Open House. Events generate a lot of interest and often attract children with disabilities and their parents who, after meeting DO-IT Scholars and Mentors, are encouraged to use technology and to pursue science, engineering, and mathematics interests.

It is too early to measure the ultimate impact of the DO-IT project, but evidence has begun to appear in the many successes of the DO-IT Scholars so far. Four DO-IT Scholars graduated from high school in 1994 and are pursuing college programs in genetics, computer programming, electrical engineering, and general studies in preparation for more advanced studies in science. One Scholar won a NASA Space Grant four-year scholarship to the University of Washington; she became aware of the scholarship program during a DO-IT summer study session. A DO-IT Scholar won an honor for his essay about the Internet in a national contest sponsored by the National Science Foundation, National Center for Education Statistics, and NASA; he was invited to speak at the Washington State Governor's Technology Conference. Two participants worked with a Mentor to organize a field trip for Scholars and other students with disabilities to Battelle Pacific Northwest Laboratories in Richland, Washington; one earned a paid summer internship at the Labs. DO-IT Scholars have appeared on local television and radio shows and in conference presentations. One Scholar is working part-time at Microsoft and in the Adaptive Technology Lab at the University of Washington. A DO-IT Scholar is now the editor of DO-IT News, the project newsletter.

DO-IT Scholars and Mentors have formed the nucleus of an electronic community of people who share both a love of science, engineering, and mathematics, and the challenges of a disability. DO-IT sponsors one-day college transition workshops and adaptive technology seminars open to on- and off-campus individuals with disabilities, families, service providers and educators. These programs extend the impact of the DO-IT project to a large audience, helping more students with disabilities transition and adjust to college life and make effective use of information technologies. Plans are underway to teach day camps on the use of computers and the Internet to young children; most of the instruction will be done by experienced Scholars.

Involvement of corporate sponsors in DO-IT Scholar activities is expected to pay off in terms of more accessible workplaces for individuals with disabilities. A Microsoft representative states, "I sincerely hope and expect to someday count DO-IT graduates among my colleagues at Microsoft." For Battelle Pacific Northwest Laboratories, involvement in the DO-IT project has "provided a way for our staff scientists and educators to learn first hand what we can do to ensure that our working environment welcomes students of diversity, including those with disabilities. The overarching goal of our participation is to enrich science and technology by opening the door to a diverse, highly talented work force. We consider ourselves a partner with the University of Washington in the DO-IT program. Through DO-IT, we have been able to link students to our scientists via Internet, provide opportunities for scientists to interact in person with disabled students including hosting DO-IT Students for a tour of our laboratories, and provide a summer internship for a selected DO-IT student."

Access and Acceptance. DO-IT works to create a barrier-free campus for students with disabilities, particularly in the academic areas of science, engineering, and mathematics. The latest adaptive technologies are available in convenient locations. Students with disabilities were surveyed to access the barriers they have faced and plans are underway to survey computer and science labs to pinpoint accessibility problems, recommend solutions, and implement recommendations.

The most effective way DO-IT improves access and attitudes towards students with disabilities is to invite University faculty to teach in the summer study program for DO-IT Scholars. Staff provide assistance in making presentations and labs accessible to all Scholars. Without exception, instructors come away with a positive impression of the capabilities of students with disabilities and a better understanding of access requirements.

Disability awareness presentations are delivered regularly to faculty. These programs reach a wide audience and increase awareness of the potential of students with disabilities, improve attitudes towards students with disabilities, and provide creative and practical approaches for ensuring access to educational opportunities. A short videotape, funded by U.S. West Communications, introduces viewers to faculty and post-secondary students with disabilities demonstrating successful techniques that allow full participation in academic programs and careers. NEC Foundation of America has assisted with nation-wide distribution of the videotape and accompanying presentation materials. Plans are underway to adapt the model used for faculty to similar presentations for precollege educators and employers.

Electronic tools on the Internet allow DO-IT participants, mentors and staff to reach a large and growing audience of thousands world-wide. Electronic discussion lists and a gopher server deliver program and disability-related information and facilitate communication on issues related to participation of individuals with disabilities in science, engineering, and mathematics. Printed materials also promote the inclusion of individuals with disabilities in science, engineering, and mathematics fields and promote the use of access technologies to level the playing field for individuals with disabilities in the information age.

In summary, DO-IT helps students with disabilities transition to post-secondary studies and careers in science, engineering, and mathematics and creates a positive and accessible learning environment for students with disabilities programs. The long-term outcome of projects like DO-IT will be to increase the number of individuals with disabilities in science, engineering, and mathematics professions.

Recommendations and Conclusion

A review of the literature and of the experiences at the University of Washington lead to several recommendations to promote the inclusion of people with disabilities in science, engineering, and mathematics academic programs and careers.

Preparation. To help students with disabilities become prepared to pursue these fields efforts should be undertaken to:

- Help people with disabilities develop independent-living and self-advocacy skills and facilitate transitions to college and employment.
- Encourage students with disabilities to take mathematics and science classes in high school and college so that they can pursue careers in science, engineering, and mathematics.
- Establish positive, motivational, and

lasting interactions between disabled high school and college students and practicing engineers and scientists who have disabilities.

- Make sure students with disabilities begin to use computers, electronic communications, and network resources to increase their independence in pursuing academic studies at an early age.

Access. To improve access to science, engineering and mathematics fields we must:

- Make facilities, computers, science equipment, and programs accessible to people with a variety of disabilities.
- Assure that scientific and mathematics publications are readily available in appropriate alternative formats.

Acceptance. In order to create a positive environment for learning and working, efforts should be undertaken to:

- Increase the awareness of pre-college and college educators regarding the potential contributions and accommodation needs of people with disabilities.
- Help employers and co-workers appreciate the potential contributions of people with disabilities and create a flexible work environment where productivity can be maximized.

In all of these efforts successful individuals with disabilities should be given opportunities to share the specialized expertise they have developed through their own personal experiences. Individuals with disabilities can be empowered with opportunities to apply their skills in efforts to promote the participation of other individuals with disabilities in science, engineering, and mathematics academic programs and careers.

We must continue to increase the understanding of factors affecting the underrepresentation of individuals with disabilities, implement creative programs to address problems, and share successful practices. Many small steps taken locally can, together, create a substantial impact and move us closer to a shared vision where people with disabilities have equal access to opportunities in science, engineering, and mathematics.

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LEGAL ISSUES

Federal legislation mandates that, when needed, academic accommodations be made to ensure that students with disabilities have educational opportunities equal to those of their non-disabled peers. Studies show that educators, staff, and students who have had interactions with students with disabilities generally have more positive attitudes about working with these students. Further, those who are familiar with accommodation strategies are better prepared to make arrangements which will ensure that students with disabilities have equal opportunities for participation.

View the videotape presentation titled *Working Together: Faculty and Students with Disabilities*. The presentation will introduce you to several faculty members and students with disabilities who have successfully worked together. In this videotape, instructors share their concerns about and strategies for working with students who have disabilities. In addition, successful students with disabilities tell the viewers firsthand about techniques and accommodations that contributed to their success. The videotape presentation emphasizes the importance of the faculty-student relationship. Information about the speakers featured is provided in the handout *Meet the Speakers in the Videotape – Working Together: Faculty and Students with Disabilities*.

The people in this videotape describe some of the problems and solutions that surfaced in their academic experiences. We encounter these issues in our science and mathematics programs. Accommodation strategies may be simple; however, they may also require a bit of creativity and flexibility. If we take some time to think about how to make our courses accessible to everyone, we'll be better prepared to overcome current and future academic challenges. This videotape may have sparked some questions that will be addressed in the next few sections.

The information covered in the videotape presentation is included in the handout *Working Together: Faculty and Students with Disabilities*. This publication provides an overview of legal rights and responsibilities and examples of accommodation strategies. It also includes space for campuses to list specific resources available to help educators work with students who have disabilities. Let's begin with legal obligations.

According to Section 504 of the Rehabilitation Act (ADA) of 1973 and the Americans with Disabilities Act of 1990, "no otherwise qualified individual with a disability shall, solely by reason of his or her disability, be excluded from the participation in, be denied the benefits of, or be subjected to discrimination under any program or activity of a public entity."

So, what exactly does "person with a disability" mean? "Person with a disability" means "any person who has a physical or mental impairment which substantially limits one or more major life activities including walking, seeing, hearing, speaking, breathing, learning, and working; has a record of such impairment; or is regarded as having such an impairment."

Disabilities covered by legislation include, but are not limited to, spinal cord injuries, loss of limbs, Multiple Sclerosis, Muscular Dystrophy, Cerebral Palsy, hearing impairments, visual impairments, speech impairments, specific learning disabilities, head injuries, psychiatric disorders, Diabetes, Cancer, and AIDS. The examples listed here are conditions which limit the ability of people to perform certain tasks. Some of these conditions are readily apparent; some are invisible.

Students who have conditions with the same label may have very different abilities when it comes to performing specific tasks. For example, one student who has Cerebral Palsy may have difficulty walking. For another student, Cerebral Palsy may result in no functional use of her hands or voice. Ultimately, a student who has a disability requires alternative arrangements only when faced with a task that requires a skill that his disability precludes.

A requirement of the Individuals with Disabilities Act of 1990 (IDEA) is that K-12 students with disabilities be educated in the least restrictive environment and to the maximum extent appropriate with students who do not have disabilities. Over the past few years there has been a steady increase in the number of students with disabilities placed in regular education classrooms.

A teacher should not assume that a student who has a disability cannot successfully participate in his course, simply because of the disability. Instead, the teacher and student (together with other appropriate school staff) should anticipate which course activities may be problematic and determine which strategies and resources are available to minimize the problems and maximize participation. Sometimes an effective solution can be found by thinking creatively about how the learning environment can be modified.

Inclusion of students with disabilities in the regular classroom offers both a challenge and an opportunity to educators. The challenge is to effectively provide an education for students with a wide array of learning styles and accommodation requirements. The opportunity is to create a society that fully includes "all" persons and allows everyone to contribute.

To sum up, legislation requires that we fully include students with disabilities in our classes. We should identify and implement academic accommodations which will ensure that they have educational opportunities equal to those of their non-disabled peers. Few of us have the experience to identify the effects of all disabilities on the learning process. We can work with a student as well as professionals when determining and implementing appropriate academic accommodations.

With growing numbers of students with disabilities joining regular classes and with legal and ethical directives to provide an appropriate and integrated education for all citizens, it is important for all educators to know how to fully include students with disabilities in classroom activities.

There are many ways that disabilities affect students' abilities to learn. Disabilities and learning styles are unique to individuals. Many accommodations are simple, creative alternatives for traditional ways of doing things. Following are examples and suggestions. They are by no means comprehensive. You and your students will have opportunities to generate additional uniquely effective ideas.

Low Vision

By "low vision" we are referring to people who have visual impairments but have some usable sight. This includes some students who are "legally" blind. For students who have low vision, standard written materials may be too small to read and/or objects may appear blurry. Others may only see objects within a specific field of vision. Still others see images with sections missing or blacked out. Learning via a visual medium may take longer and may be more mentally fatiguing for people who have low vision than for people who have standard vision.

Examples of accommodations for students with low vision include large print books, handouts, signs, and equipment labels. Many photocopy machines can enlarge text.

Some students with low vision benefit from materials on audio-tape. It may take weeks or months to procure class materials in audio-tape format. Consequently, it is essential that instructors select and prepare their materials well before the materials are needed.

Other examples of accommodations for people with low vision include providing seating where the lighting is best; television monitors connected to microscopes to enlarge images; class assignments made available in electronic formats; and computers equipped with screen enlargers.

Blindness

Students who have not had vision since birth may have difficulty understanding verbal descriptions of visual materials and abstract concepts. Consider the example, "This diagram of ancestral lineage looks like a tree." If one has never seen a tree, it may not be readily apparent that the structure of note has several lines of ancestry which can be traced back to one central family. However, students who lost their vision later in life may find it easy to understand this verbal description. Additionally, demonstrations based on color differences may be more difficult for students with blindness to understand than demonstrations which emphasize changes in shape, temperature, or texture.

Students who have no sight cannot read written materials in standard format. Ready access to printed materials on computer disks or via the Internet allow blind students, who have the appropriate technology, to use computers to read text aloud and/or produce Braille. Some materials may need to be transferred to audio-tape. Since it may take weeks or even months to procure course materials in Braille or on audio-tape, it is essential that teachers select and prepare their materials well before the materials are needed.

During lectures and demonstrations, clear, concise narration of the basic points being represented in visual aids is helpful. Other examples of accommodations for blind students include tactile models and raised-line drawings of graphic materials; adaptive lab equipment such as talking thermometers, calculators, light probes, and tactile timers; and computers with optical character readers, voice output, Braille screen displays, and Braille printers.

Hearing and Speech Impairments

Some students who have hearing impairments may hear at a functional level with the assistance of amplification devices. Others hear only specific frequencies, sounds within a certain volume range, or nothing at all. Individuals with hearing impairments often use some combination of lip-reading, sign language, and amplification to understand spoken information. Students who are deaf from birth generally have more difficulty speaking and understanding the structure of the English language than those who lost their hearing later in life.

Students with hearing impairments may have difficulty following lectures in large halls, particularly if the acoustics cause echoes or if the speaker talks quietly, rapidly, or unclearly. They may find it difficult to simultaneously watch demonstrations and follow verbal descriptions if they are watching a sign language interpreter, a "real-time" captioning screen, or a speaker's lips. It may also be difficult for them to follow or participate in class discussions, particularly when they are fast-paced and unmoderated, since there is often lag time between a speaker's comments and interpretation.

Examples of accommodations for students who have hearing impairments include interpreters; sound amplification systems; note takers; visual aids; written lecture outlines, class assignments, lab instructions, and demonstration summaries; visual warning systems for lab emergencies; and electronic mail for faculty-student meetings and class discussions. Teachers should turn their faces toward students with hearing impairments when speaking and repeat discussion questions and statements made by other students.

Some disabilities affect the ability to speak. Encourage students with speech impairments to participate in class discussions. Ask them to repeat themselves when you cannot understand what they're saying and encourage other students to interact with them. Computer-based speech output systems can provide an alternative voice for students who cannot speak and electronic mail does not require the ability to speak.

Specific Learning Disabilities

Students with specific learning disabilities generally have average to above average intelligence, but may have difficulties demonstrating knowledge and understanding concepts. Auditory, visual, or tactile information can become jumbled at any point when it is transmitted, received, processed, and re-transmitted. It may take longer for some students who have learning disabilities to process written information, making lengthy reading or writing assignments or tests difficult to complete in a standard amount of time. Some students may be able to organize and communicate their thoughts in one-to-one conversations, but find it difficult to articulate those same ideas in a noisy classroom.

Examples of accommodations for students who have learning disabilities include note takers and audio-taped class sessions; extra test time; a quiet testing location; alternative testing arrangements; visual, aural, and tactile demonstrations incorporated into instruction; course and lecture outlines; and computers with voice output and spelling and grammar checkers. Be aware of environmental factors that tend to distract students. Avoid placing a student who is easily distracted near high traffic areas and consider seat, window, and door placement in relation to the student.

Mobility Impairments

Mobility impairments range from lower body impairments, which may require use of canes, walkers, or wheelchairs, to upper body impairments, which may result in limited or no use of the hands. It may take longer for students with mobility impairments to get from one class to another. For some students it may be difficult to get to field work sites. It may also be difficult for some students to manipulate objects, turn pages, write with a pen or pencil, type at a keyboard, or retrieve research materials.

Examples of accommodations for students with mobility impairments include note takers, scribes, and lab assistants; group lab assignments; extended exam time; alternative testing arrangements; accessible locations for classrooms, labs, and field trips; adjustable tables; equipment located within reach; course materials available in electronic formats; computer with special devices such as voice or Morse code input and alternative keyboards; and access to research resources on the Internet.

Health Impairments

Some health conditions and medications affect memory and/or energy levels. Additionally, some students who have health impairments may have difficulties attending classes full-time or on a daily basis.

Be flexible. Be aware of medications that a student may be taking and their potential physical and educational effects. This is particularly important for students taking medications for conditions such as seizure disorder.

Be aware that some health impairments are chronic and stable while others are sporadic (e.g., severe allergies) and require flexible accommodations. Modify your curriculum and/or methods to accommodate sporadic attendance. Additionally, allow for a student to take time off during the class period to take medication, have a snack (e.g., for a student who may be diabetic), rest, or meet with professionals.

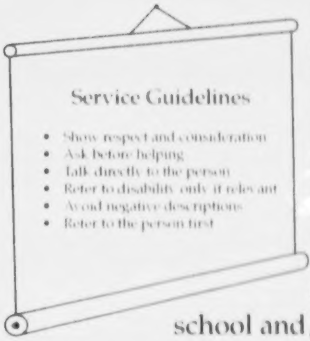
Observe the student to determine if there are times during the day or class periods when instruction is more effective. Observe changes in moods, attitudes, classroom participation, quality of work, or general health. Report concerns to parents and appropriate school personnel.

Examples of accommodations for students who have health impairments include note takers and/or taped class sessions; flexible attendance requirements; alternative testing arrangements; assignments available in electronic format; and electronic mail for faculty-student meetings, class discussions, and distribution of class materials and lecture notes.

Accommodation Summary

To conclude this discussion of accommodation examples, here are some general suggestions for making classes accessible.

- Discuss with students their needs and ideas for accommodations.
- Select materials early so that they can be procured in appropriate formats in a timely manner.
- Use materials which are available in electronic format.
- Find alternative methods of administering tests and testing comprehension of a subject.
- Use the special education services available to your school and/or district.



Service Guidelines

- Show respect and consideration
- Ask before helping
- Talk directly to the person
- Refer to disability only if relevant
- Avoid negative descriptions
- Refer to the person first

Interpersonal Interaction

People who interact with students have a great impact on their success in math and science classes. Keep in mind that students with disabilities are more like students without disabilities than they are different. Don't judge a person 100% for a characteristic that affects 10% of functioning. Do not exhibit, "Oh my ____, if I was ____!" syndrome.

Realize that all students have strengths and weaknesses. Value diversity. Nordstrom's has a lot more than 42 regulars in grey on the rack. Not everyone who is the same height and weight has the same skills and abilities. Students with disabilities have the same range of likes and dislikes as anyone else. Not all people who are blind are musical; not all people who use wheelchairs play wheelchair basketball, and not all people who are deaf read lips.

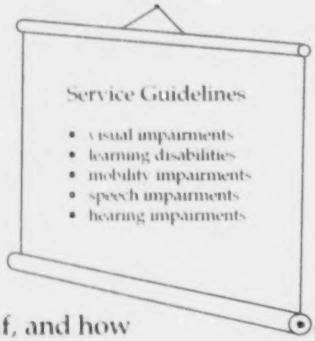
Expect that the student with a disability in your class is there to succeed. Keep your expectations high. Be positive and pro-active in helping him/her achieve success.

Below are some general guidelines for interacting with students with disabilities.

- Treat students with disabilities with the same respect and consideration that you do others.
- Ask a person with a disability if he/she needs special help before assisting. Don't make assumptions.
- Talk directly to the student with a disability, not through the person's assistant or companion.
- Refer to a person's disability only if it is relevant to the conversation.
- Avoid negative descriptions of a person's disability. For example, "a

child who uses a wheelchair" is more appropriate than "a child confined to a wheelchair."

- Refer to the person first and then the disability. "A student who is blind" is better than "a blind student" because it emphasizes the person first.
- If you have concerns about a student's performance, mention it. He may not know he is doing something incorrectly.
- If you are feeling uncomfortable about a situation, let the student with a disability know. Ask for advice for solving the problem.
- If a person appears to be having difficulty at a task, she probably is. Ask if, and how you may help. Provide assistance only if requested.



- Be aware of and adjust to environmental factors that may affect the student's performance. Examples are air conditioning noise, lighting, and fumes.

Here are some guidelines to think about when working with students with specific disabilities.

- When interacting with a student with a visual impairment, be descriptive. For example, instead of saying, "The computer is over there," say, "The computer is about three feet to your left."
- When guiding a person with a visual impairment, offer your arm rather than grabbing or pushing her.
- Always ask permission before you interact with a student's guide or service dog.
- Read instructions for the benefit of students with specific learning disabilities.
- Try sitting or crouching to the appropriate visual height to interact with a student who uses a wheelchair. Also, remember that a person's wheelchair is an extension of his/her body. It is not a footrest for you.
- Be aware of where you set items. Make sure they can be reached from a wheelchair. Avoid clutter.
- Listen carefully and ask a student with a speech impairment to repeat what he has said if you don't understand.
- Face a student with a hearing impairment and speak clearly when you talk so she can see your lips. Don't over-enunciate as this can make it more difficult for her to read your lips.

Here are additional things to consider in ensuring that lab and classroom staff and volunteers are prepared to serve students with disabilities.

- Train science and computer lab staff in the use of adaptive technology for students with disabilities.
- Make sure everyone is aware of policies and procedures for providing accommodations to students with disabilities.
- Make sure someone is knowledgeable of other organizations, such as federally-funded talking book and Braille libraries, that provide services to students with disabilities.

With well-trained, aware staff and volunteers, labs and classrooms will be welcoming place for all students, including those who have disabilities.

Videotape Presentation:

- *Opening Doors: Mentoring on the Internet*

Handout:

- *Opening Doors: Mentoring on the Internet*
- *Meet the Speakers in the Videotape — Opening Doors: Mentoring on the Internet*

Most of us can think of people in our lives, more experienced than ourselves, who have supplied information, offered advice, presented a challenge, initiated friendship, or simply expressed an interest in our deveopment as a person. Without their intervention we may have remained on the same path, perhaps continuing a horizontal progress through our academic, career, or personal lives.

Along the way adult mentors can help students with disabilities achieve success in math and science. Mentors provide direction and encouragement. They instill values and promote achievement. They can also help students develop self-advocacy and leadership skills. However, constraints imposed by time, distance, and disability make such relationships difficult to initiate.

View the videotape and presentation and read the publication titled *Opening Doors: Mentoring on the Internet* to hear first-hand about the value of mentoring and about how using the Internet for communication can overcome challenges imposed by time, distance, and disability.

DO-IT has conducted an extensive research study on the nature and value of electronic mentoring. More than 12,000 electronic mail messages were collated, coded, and analyzed; surveys were distributed; and focus groups were conducted. Results of the study suggest that computer-mediated communication can be used to initiate and sustain both peer-peer and mentor-protégé relationships. On the Internet, young people can receive support from peers and adults otherwise difficult to reach as well as connect to a rich collections of science and math resources. Participants experience benefits over other types of communication, including the ability to communicate over great distances quickly, easily, conveniently, and inexpensively; the elimination of the barriers of distance and schedule; the ability to communicate with more than one person at one time; and the opportunity to meet people from all over the world. Students with disabilities also report the added value that people treat them equally because they are not immediately aware of their disabilities.

To help your students with disabilities meet other students with disabilities and develop mentoring relationships with adults who have disabilities, encourage them to join the

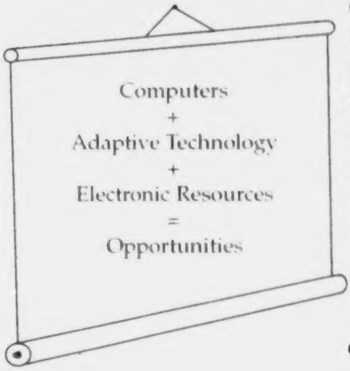
DO-IT electronic community. Check into the DO-IT Scholars and DO-IT Pals programs where teens with disabilities communicate year-round with each other and with mentors via the Internet. For information about these and other programs consult *http://www.washington.edu/doit/* or send electronic mail to *doit@u.washington.edu.*

COMPUTING ACCESS

Computers are essential tools in all academic studies, including science and mathematics. It's difficult to imagine a state-of-the-art program without thinking of computer simulations, electronic data, and interactive Internet sites.

Recent advances in adaptive computer technology, greater reliance on computers in many fields, and increased availability and networking of electronic information resources have resulted in life-changing opportunities for many people with disabilities. In combination, these technologies provide people with disabilities better access to education, careers, and other life experiences. Teachers can play an important role in assuring access to these empowering tools.

Consider a few stories of students with disabilities who are able to access information resources thanks to the availability of adaptive technology and accessible electronic resources. You'll meet them in a videotape you will view shortly. They are all students pursuing interests in the areas of science, engineering, and mathematics.



- Ben cannot use his hands, but muscular dystrophy doesn't interfere with his use of the Internet; he uses a voice input program that allows him to talk his way through the Net – six hours a day!

- Sarah uses her library's online catalog and the Internet to research and write papers for school. Her learning disability makes it difficult for her to read so she uses a speech output system to read the screen.

- Anna is blind. She uses a screen reader and speech output system to access information on genetics. Her system works well reading text, but cannot make sense of graphics.

- Shane surfs the Net with a small tube in his mouth. The computer obeys his every command as he inputs Morse code – sip for a dot, puff for a dash. His Cerebral Palsy is only a minor inconvenience as he searches for information on his special interest, naval communication.

- Sherri is legally blind, but has enough sight to use enlarged screen images as she uses governmental resources on the World Wide Web. She is pursuing her master's degree in public administration.

- Katie is hearing impaired. She often uses a sign language interpreter. On the Internet, however, Katie communicates with her science teacher quickly and easily through electronic mail.

These stories provide examples of students with disabilities who are successfully pursuing education and careers thanks to adaptive technology and electronic resources. Throughout this section you will learn how to ensure that there will be many more success stories like these for people with disabilities. The information covered will provide you with tools and insights that will help ensure that computing resources at your school are accessible to all students. As an extra benefit, you will find that being sensitive to the needs of people with disabilities can often make access easier for everyone.

The section is organized as follows:

Computer Lab Access

Physicial Environment

Adaptive Technology

Low Vision
Blindness
Hearing and Speech Impairments
Specific Learning Disabilities
Mobility Impairments
Health Impairments
Planning for Adaptive Technology

Access to Electronic Resources

Universal Design Principles
Accessible Web Design
    General Page Designs
    Graphical Features
    Special Features
    Web Pages Test

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COMPUTER LAB ACCESS

Videotape Presentation:

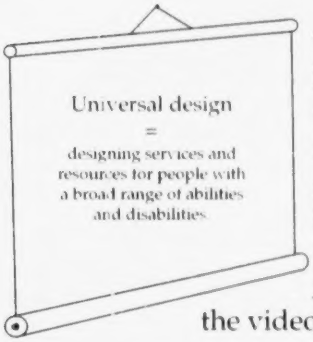
- *Equal Access: Computer Labs*

Handout:

- *Equal Access: Computer Labs*

As more information is delivered using computer and network technologies, school computer labs play an increasingly important role in ensuring access to electronic information resources. In making electronic resources accessible, principles of universal design should be employed.

Typically, organizations design their services and facilities for the average user. Universal design means that you design them for people with a broad range of abilities and disabilities. Keep in mind that students may have learning disabilities and visual, speech, hearing, and mobility impairments.



Universal design

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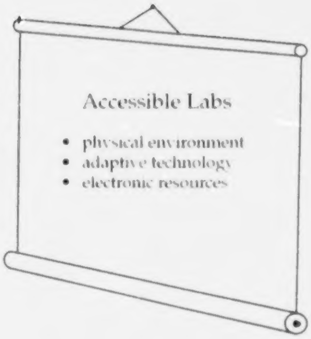
designing services and resources for people with a broad range of abilities and disabilities

To plan an accessible lab, think in terms of the following access issues: physical environment, adaptive technology, and electronic resources. These areas are addressed in the videotape presentation and handout, each titled *Equal Access: Computer Labs.* You can use the list of guidelines in the handout as a starting point for surveying your school lab for accessibility.



Accessible Labs

- physical environment
- adaptive technology
- electronic resources

You may find the list of suggestions presented intimidating as you begin to think about the planning and funding processes involved in implementing all of the suggestions. You may feel that you have to start from scratch and build a whole new computer lab in order to have an accessible facility. However, some of the items have probably already been addressed. With this information, you can develop strategies to begin implementing some of the ideas not already in place. If you cannot take on an expensive project at this time, consider the many low-cost things you can do to begin making school computer labs more accessible.

First, look at the physical environment of the computer lab.

Physical Environment

Designing a lab that is universally accessible begins with the physical environment of the facility. Ask these questions in determining how to make your facility more accessible.

- Are doorway openings at least 32 inches wide and doorway thresholds no higher than 1/2 inch?

- Are aisles kept wide and clear for wheelchair users? Have protruding objects been removed or minimized for the safety of users who are visually impaired?

- Are all levels of the lab connected via a wheelchair accessible route of travel? If some materials are in inaccessible locations, are there procedures for retrieving these materials for students with mobility impairments?

- Are ramps and/or elevators provided as alternatives to stairs? Do elevators have both auditory and visual signals for floors? Are elevator controls marked in large print and Braille or raised notation? Can students seated in wheelchairs easily reach all elevator controls?

- Are wheelchair-accessible restrooms with well-marked signs available in or near the lab?

- Are service desks wheelchair accessible?

- Are there ample high-contrast, large print directional signs throughout the lab? Is equipment marked with large print and Braille labels?

- Are hearing protectors, private study rooms, or study carrels available for users who are distracted by noise and movement around them?

- Is at least one table for each type of computer adjustable so that a student who uses a wheelchair can type comfortably? Can the adjustment controls be reached by the wheelchair user?

- Are wrist rests available for those who require extra wrist support while typing?

- Are document holders available to help position documentation so that it can be easily read?

Videotape Presentation:

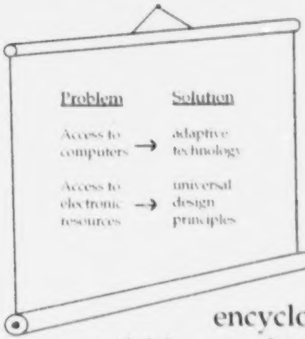
- *Working Together: People with Disabilities and Computer Technology*

Handouts:

- *Working Together: People with Disabilities and Computer Technology*
- *Meet the Speakers in the Videotape – Working Together: People with Disabilities and Computer Technology*

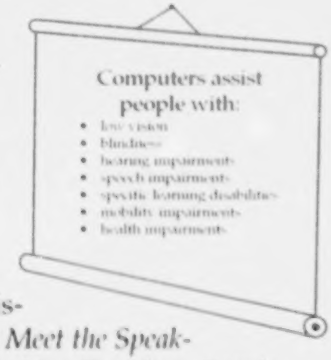
Using computing resources can increase the independence, capabilities, and productivity of students with disabilities. Computers can benefit people with low vision, blindness, hearing impairments, speech impairments, specific learning disabilities, mobility impairments, and health impairments.

Access to computing resources for students with disabilities involves two issues: access to the computers themselves and access to electronic resources. Electronic resources include applications programs such as word processors and spreadsheets and information resources such as encyclopedias and databases available over the Internet.


Problem
Solution
Access to computers → adaptive technology
Access to electronic resources → universal design principles

In this section we will look at the solutions that adaptive technology provides in enabling access to computers for people with disabilities. We will explore how the application of universal design principles can reduce or eliminate barriers to electronic resources in the section that follows.

View the videotape presentation and look over the accompanying handout each titled *Working Together: People with Disabilities and Computer Technology*. They give an overview of computer access problems and solutions. The video highlights some of the special advantages access to computers, adaptive technology, software and the Internet provides to people with specific disabilities. The handout *Meet the Speakers in the Videotape – Working Together: People with Disabilities and Computer Technology* provides information about the students featured in the videotape presentation.



As the individuals in the videotape demonstrate, computers help lower many barriers faced by people with disabilities. They demonstrate various technologies that make it possible for people who have disabilities to use computing resources. These are only examples, since abilities, disabilities, and learning styles are unique to individuals. Many accommodations are simple, creative alternatives for traditional ways of doing things. You and your students can generate other effective ideas.

Next we will review this information and consider examples of accommodations that allow people with disabilities to effectively utilize electronic resources.

Low Vision

For some students who have low vision, standard written materials are too small to read and/or objects may be blurry. Others may only see objects within a specific field of vision. Still others may see an image with sections missing or blacked out. Learning via a visual medium may be more mentally fatiguing for people who have low vision than for people who have standard vision.

Low Vision

- large print signs, handouts, labels
- good lighting
- large print key labels
- large monitors
- software to enlarge screen images
- software to adjust screen colors

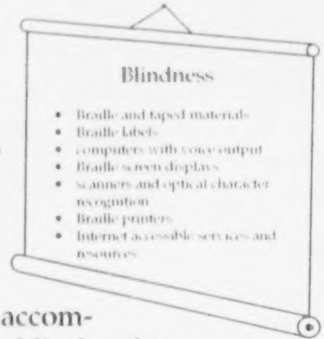
Examples of general accommodations for students with low vision include large print books, handouts, signs, and equipment labels. The most heavily used lab handouts should be available in alternative formats, including large print and electronic versions. Provide seating with good lighting. Providing areas with dim lighting may also be helpful for those who are light sensitive.

There are several computer technologies that will assist students with low vision as well. Computers equipped with large print key labels and home-row key indicators can help users with visual impairments locate keys. Large monitors and anti-glare screens can also assist those with low vision. Computers equipped with screen enlarger software can enable people with low vision to read characters on the screen without assistance; large monitors allow them to maximize the amount of text they can see at one time.

The ability to adjust the colors of the screen or change the foreground and background colors can also help some students. For example, for those sensitive to light, it can be helpful to reverse screen colors from black on white to white on black. Some operating systems have accessibility options such as this built into them. There are also accessibility software packages that will perform these functions in concert with standard software.

Blindness

Blindness affects the ability to access printed materials independently. Some students who are blind know how to read Braille; others do not. Materials can be taped or provided in Braille to accommodate students who are blind and can read Braille. Braille labels on equipment, keypads, and book stacks can assist with general lab accessibility. However, adaptive computer technology can afford a blind person with greater flexibility and independence in utilizing computer lab and Internet resources.



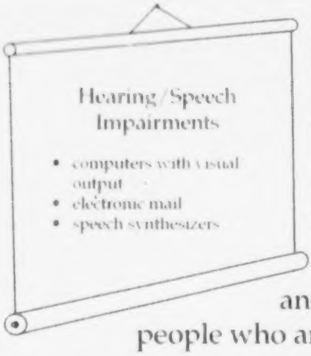
Blindness

- Braille and taped materials
- Braille labels
- computers with voice output
- Braille screen displays
- scanners and optical character recognition
- Braille printers
- Internet accessible services and resources

Computer voice output systems can be used to read screen text to students who are blind. Special software programs "read" computer screens and speech synthesizers "speak" the text. The availability of earphones for individuals using voice output systems can reduce the distraction to others nearby.

Refreshable Braille displays allow line-by-line translation of text on the screen into Braille on a display area where vertical pins move into Braille configurations as screen text is scanned. Braille displays can be read quickly by those with advanced Braille skills, are good for detailed editing (e.g., programming and final editing of papers), and do not disrupt others in work areas because they are quiet. Braille translation software combined with Braille printers provide output for blind users who know how to read Braille.

Scanners with optical character recognition capabilities can read printed material and store it electronically on computers, where it can be read using voice synthesis or printed using Braille translation software and Braille printers. Such systems provide independent access to journals, books, and other information for people who are blind.



Providing lab resources electronically can help students who are blind to utilize lab services independently and conveniently. Some hardware and software vendors also provide Braille or ASCII versions of their documentation to support blind users.

Hearing and Speech Impairments

For students who have hearing impairments, examples of accommodations include visual, as well as auditory, signals for fire alarms, lab closing signals, and other alerts. Some students with hearing impairments need a quiet environment to hear effectively. Sign language interpretive services for lab instruction should be available when requested.

Hearing and speech disorders alone do not generally interfere with computer use. In fact, electronic mail can be used to facilitate communication between students and teachers.

When using a computer, alternatives to audio output can assist users with hearing impairments. For example, a computer that produces a tone when an error is made can be programmed to flash the screen instead. Word processing and educational software may also help individuals with hearing impairments develop writing skills.

Speech synthesizers can act as substitute voices and provide a compensatory tool for students who cannot communicate verbally. Individuals with portable systems can ask questions and join in conversations when adapted computers provide them with intelligible speaking voices.

Specific Learning Disabilities

Computers can help people with learning disabilities focus and better understand information. For example, adaptive technology that provides multi-sensory experiences, such as displaying information in text while it is being read by a voice synthesis program, can increase some people's reading speed.

Software that aids in efficient and accurate input can also assist students with learning disabilities. They can compensate for high rates of input errors by using spelling checkers, thesauruses, and grammar checkers. In addition, word prediction programs (software that predicts words from fragments) have been used successfully by students with learning disabilities. Similarly, macro software which expands abbreviations can reduce the necessity to memorize keyboard commands and can ease the entry of commonly used text.

Some people with learning disabilities find adaptive devices designed for those with visual impairments useful. In particular, large print displays, alternative colors on the computer screen, and voice output can compensate for some reading problems. Students who have difficulty interpreting visual material can improve comprehension and the ability to identify and correct errors when words are spoken or printed in large fonts.

Some individuals with learning disabilities are hyper-sensitive to background noise. Quiet work areas and hearing protectors may make it easier for some students to study and work in the computer lab.

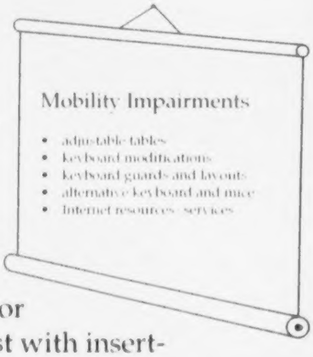
Mobility Impairments

Mobility impairments may involve lower body impairments or may result in limited or no use of hands. For some students it may be difficult to manipulate objects, turn pages, write with a pen or pencil, type at a keyboard, or retrieve research materials.

Examples of general lab accommodations for students with mobility impairments include lab assistants, adjustable tables, wrist rests, equipment located within reach, and materials available in electronic format.

Equipment which provides flexibility in the positioning of monitors, keyboards, documentation, and table tops is useful for many individuals with disabilities. Plugging all computer components into power outlet strips with accessible on/off switches makes it possible for some individuals to turn equipment on and off independently.

Some adaptive hardware and software assist students with little or no use of their hands in using a standard keyboard. Individuals who have use of one finger, a mouth- or head-stick, or some other pointing device, can control the computer by pressing keys with the pointing device. Software utilities can create "sticky keys" that electronically latch the SHIFT, CONTROL, and other keys to allow sequential keystrokes to input commands that normally require two or more keys to be pressed simultaneously. The key repeat function can be disabled for those who cannot release a key quickly enough to avoid multiple selections.


Mobility Impairments
adjustable tables
keyboard modifications
keyboard guards and layouts
alternative keyboard and mice
Internet resources / services

Simple hardware modifications can help individuals with mobility impairments. For example, disk guides can assist with inserting and removing diskettes; a dedicated hard disk and/or computer network can eliminate or reduce the necessity to do so. Keyguards can help those with limited fine motor skills select keys. A keyguard is a plastic cover that fits over a standard keyboard with holes for the keys. Individuals with mobility impairments use the cover as a guide to more accurately select keys.

For students who need to operate the computer with one hand, left- and right-handed keyboard layouts are available. Alternatively, a keyboard layout software program can be used to alter the letter and number key arrangement of a standard keyboard to be adapted for one-handed use.

Some hardware modifications completely replace the keyboard and/or mouse for individuals who cannot operate these standard devices. Track balls and alternative pointing devices can replace mice. Expanded keyboards (larger keys, spaced far apart) can replace standard keyboards for those with limited fine motor control. Mini keyboards provide access to those who have fine motor control but lack a range of motion great enough to use a standard keyboard.

For students with more severe mobility impairments, keyboard emulation is available, including scanning and Morse code input. In each case, special switches make use of at least one body part over which the individual has voluntary control (e.g., head, finger, knee, mouth). In scanning input, lights or cursors scan letters and symbols displayed on computer screens or external devices. To make selections, individuals use switches activated by movement of the head, finger, foot, breath, etc. Hundreds of switches tailor input devices to individual needs. In Morse code input, users create Morse code by activating switches (e.g., a sip-and-puff switch registers dot with a sip and dash with a puff). Special adaptive hardware and software translate Morse code into a form that computers understand so that standard software can be used.

Voice input provides another option for individuals with disabilities. Speech recognition systems allow users to control computers by speaking words and letters. A system is "trained" to recognize specific voices.

Special software can further aid students with mobility impairments. Abbreviation expansion (macro) and word prediction software can reduce input demands for commonly-used text and keyboard commands. Word prediction software anticipates entire words after a few keystrokes and increases input speed.

Internet accessible resources and services are useful for students with mobility impairments who cannot manipulate traditional books. They make independent access to information possible.

Health Impairments

Some health conditions and medications affect memory and/or energy levels. Additionally, some students who have health impairments may not be able to visit the lab facility. Providing class information via the Internet and corresponding via electronic mail can benefit students who can obtain access to the Internet from their homes or the hospital.

Planning for Adaptive Technology

From ideas presented in the videotape and the examples of accommodations we've discussed, you can see how computer and network technologies can play a key role in increasing the independence, productivity, and participation of students with disabilities. Now that we've considered the various types of adaptive technology, let's think generally about some of the characteristics of adaptive technology to consider as you plan to incorporate such technology into your lab.

Adaptive technology comes in many forms with many different characteristics. It comes as hardware, software, or a combination of the two. In the videotape presentation *Working Together: People with Disabilities and Computer Technology*, Daniel, who has a learning disability, uses spelling and grammar checking software with a standard computer and commercial software programs. On the other hand, Hollis controls his computer with specialized hardware — a joystick and a footswitch. He also uses special software, including a Morse code translation program, to work with these devices.

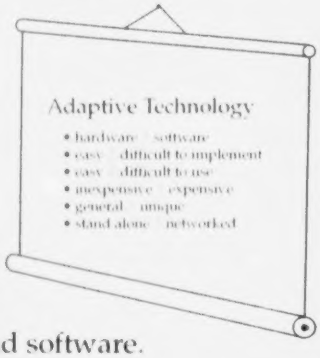
Adaptive technology can be easy to install or can require long-range planning, analysis of needs and options, and funding for implementation. For example, a track ball is inexpensive and can be easily added to a workstation, assisting people who have difficulty using a standard mouse. On the other hand, Eric, one of the speakers in the videotape, uses hardware that includes a personal computer, screen reading software, speaker, scanner, Braille translation software, and Braille printer. Setup and support of such a system requires a significant financial investment, technical expertise, and long term planning.

Adaptive technology can be easy to use or difficult to learn, requiring a great deal of commitment on the part of the individual user. For example, an expanded keyboard plugs into a standard keyboard holder on the computer and operates like a regular keyboard. On the other hand, a voice input system requires training to use. Each user must train the system to recognize his or her voice.

Adaptive technology can be generic or unique to the individual. For example, screen enlargement software serves people with a variety of levels of visual and learning impairments. On the other hand, the mouthstick system that Rodney demonstrates in the video is more specialized.

Adaptive technology software solutions, such as screen enlargement programs, can be installed on one machine or networked so that they are available from more than one computer workstation. Solutions which incorporate hardware are often most appropriate on stand-alone stations. However, if these are stored near computer workstations, they can be easily moved to the particular station a student is using.

Given these characteristics of adaptive technology, you should consider multiple approaches to providing accommodations. Some solutions can be implemented quickly and easily and will provide quick successes to motivate additional support for the longer processes required to install more complex equipment and software.


Adaptive Technology
• hardware / software
• easy / difficult to implement
• easy / difficult to use
• inexpensive / expensive
• general / unique
• stand alone / networked

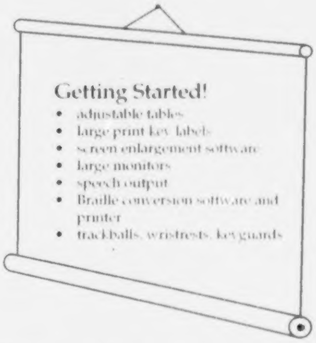
In a computer lab, it is desirable to provide options at a computer workstation which address the needs of a variety of students.

You should also have procedures in place to, in a timely manner, deal with specific needs that these general solutions cannot address. Work with the student to come up with creative, simple solutions. In the videotape presentation you saw Mitch, whose surgery required him to lay on his side on a cart for an extended period of time. Staff turned Mitch's monitor on its side and built a holder for his keyboard. That's what we mean by creativity!

Remember, you don't have to do everything at once. Start small and add to your collection of adaptive technology as you receive requests and as lab staff gain skills in providing training and services for them. Here is a sample of some of the adaptive technology you might want to purchase in order to get started right now.

- At least one adjustable table for each type of electronic resource provides access to students who use wheelchairs or are short in stature.
- Large print key labels assist students with low vision.
- Software to enlarge screen images provides access to students with low vision and learning disabilities.
- Large monitors of at least 17 inches assist students with low vision and learning disabilities.
- A speech output system can be used by students with low vision, blindness, and learning disabilities.
- Braille conversion software and a Braille printer can provide Braille output for students who are blind.
- Trackballs provide an alternative for those who have difficulty controlling a mouse.
- Wrist rests and keyguards assist students with limited fine motor skills.

This section addressed adaptive technology. You viewed a videotape and reviewed materials that show how adaptive technology can assist students with low vision, blindness, hearing impairments, speech impairments, specific learning disabilities, mobility impairments, and health impairments.


Getting Started!
adjustable tables
large print key labels
screen enlargement software
large monitors
speech output
Braille conversion software and printer
trackballs, wristrests, keyguards

The next section addresses another part of the access equation – using universal design principles to ensure that electronic resources are accessible.

Listen to the Experts

When working with students with disabilities in you class, talk to them about how their disabilities will affect their learning and performance and then discuss accommodation alternatives. They are (or should be becoming) the experts on their disabilities. Including them in the accommodation process will help them develop skills that are essential as they transition to adult life. DO-IT Scholars develop these problem-solving skills in high school.

For example, after a long day of activities on a hot summer afternoon in the DO-IT Summer Study program, dedicated DO-IT Scholars came together to discuss learning strategies. All of the participants were dealing with learning issues as a result of their disabilities. Disabilities represented in the group of students included specific learning disabilities, Attention Deficit Disorder (ADD), Attention Deficit Hyperactivity Disorder (ADHD), Tourette's Syndrome and head injury. First, each Scholar shared at least one way that his/her disability has impacted their ability to learn. Impacts mentioned included that he/she:

- is slow at taking tests,
- is slow reading,
- has messy handwriting,
- has difficulty expressing thoughts in writing,
- feels frustrated,
- is unorganized,
- is easily distracted
- feels stupid, and
- feels overwhelmed.

They all agreed that their disabilities do in fact impact their ability to learn in a typical classroom. They agreed that they all have the ability to learn. Then they listed strategies that help them succeed in academics in spite of their learning challenges. These strategies allow them to work to their full potential and demonstrate their true educational abilities. Solutions mentioned during this brainstorming session are listed below.

- Talking to the instructor to find out what he/she would suggest doing to succeed in the class.
- Controlling the environment to minimize distractions.
- Studying during times of the day when they have the most energy.
- Arranging for extended time on tests.
- Taking tests orally.
- Outlining ideas and information while reading or reviewing notes.
- Using different color pens to highlight key points.
- Using colored transparent screens to cover pages or computer screens while reading.
- Using a computer (especially, word processors and spelling checkers).
- Using a large print font on the computer.
- Using a grammar checker.
- Utilizing study groups.
- Taking breaks from reading to keep their mind fresh.
- Tape recording lectures.
- Reading out loud or having someone else read them.
- Getting notes from the teacher or another person in the class.
- Using a class planner.

The participants in the group found that they have some shared solutions and some unique solutions. They found that a solution that may make a difference for one person might not help another. They also learned that they need to be active in helping to figure out what works for them, determining which strategies they can implement, and which accommodations need to be requested from the teacher. While others can make suggestions, it's up to students with the disabilities to try out accommodations and then decide whether or not they provide effective solutions. They need to become experts on their disabilities and the unique accommodations that will work for them. Additionally, it is critical that teachers work with them to further develop accommodation and self-advocacy skills.

ACCESS TO ELECTRONIC RESOURCES

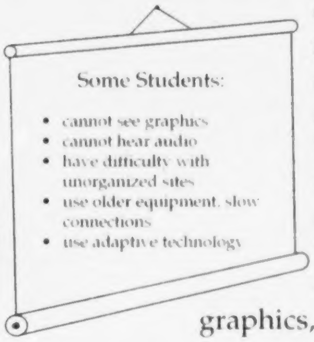
Videotape Presentation:

- *World Wide Access*

Handouts:

- *World Wide Access: Accessible Web Design*
- *Meet the Speakers in the Videotape — World Wide Access*

Development of sophisticated multimedia electronic and World Wide Web resources has extended the reach of computers. Increasingly, however, these resources are not fully accessible to people with some types of disabilities. For example, screen reader software with a speech synthesizer used by a student who is blind cannot interpret tables, graphics, or video clips.



Some Students:

- cannot see graphics
- cannot hear audio
- have difficulty with unorganized sites
- use older equipment, slow connections
- use adaptive technology

Some students cannot see graphics because of visual impairments or cannot hear audio because of hearing impairments. Some have difficulty when screens are unorganized, inconsistent, and cluttered and when descriptions and instructions are unclear. These difficulties may occur because they have learning disabilities, speak English as a second language, or are younger than the average user. Other students use older equipment or slow connections or modems that limit their access to multimedia features.

As more information is delivered using computer and network technologies, schools play an increasingly important role in ensuring access to electronic information resources for all students.

When evaluating accessibility of electronic resources, remember to consider the online catalogs; school resources; electronic indexes and full text resources such as encyclopedias, available through stand-alone stations or networked terminals; and Internet resources on the World Wide Web.

Accessibility should also be considered when purchasing new electronic resources for the school. Ask the vendor if the product has been tested for accessibility and, specifically, if the product is compatible with screen reading software. Develop a policy that electronic products in your school be reviewed for accessibility before purchase.

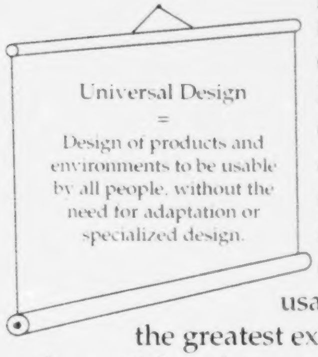
Electronic resources designed or developed in-house, such as school and district Web pages, online catalogs, and local digital library projects, should be developed with universal access as a goal. Accessibility guidelines should be incorporated into Web page standards.

Then, as a backup, make it a priority to buy and develop accessible resources. Be prepared to assist students with electronic resources that they cannot access independently.

Universal Design Principles

In making electronic resources accessible, principles of universal design should be employed. Following universal design principles can help ensure that all students will be able to independently utilize your electronic resources, regardless of their disabilities or the limitations of their equipment and software.

Typically, organizations design their electronic services for the average user. Universal design means that you design them for people with a broad range of abilities and disabilities. The Trace Research and Development Center has defined universal design as: "The design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design." (*http://www.trace.wisc.edu/text/univdesn/ud_princ/ud_princ.html*)


Universal Design
=
Design of products and environments to be usable by all people, without the need for adaptation or specialized design.

Universal design principles can be applied to both facilities and tools. They are especially appropriate to consider when designing electronic resources, including online catalogs, educational software, and electronic reference sources in CD-ROM or other formats, or on the Internet. Adapted from a listing by Trace, here are some general guidelines to consider in designing an electronic resource.

Universal Design
Principles

- equitable use
- flexible use
- simple and intuitive use
- information duplicated in several formats
- low physical effort

- Design the resource so that it can be used by anyone. Provide the same means of use for all users — identical when possible; equivalent when not. Avoid segregating or stigmatizing any potential users.

- The resource should be flexible in the ways that it can be used, accommodating a wide range of individual preferences and abilities. Provide choice in methods of use, for example, accommodate both right- and left-handed access.

- The design should be simple, allowing the resource to be used with minimal training. The resource should be easy to understand, regardless of the user's age, experience, knowledge, language skills, or current concentration level.

- Information should be provided redundantly. The variety of formats included should accommodate people with visual, hearing, and other impairments. Use several different modes (e.g., pictures, text) to provide essential information. Make the resource compatible with current adaptive computer technologies.

- Design the resource so that minimal physical effort is required to operate it.

Accessible Web Design

In this section we'll apply universal design principles to a common activity in schools today, designing Web pages. The World Wide Web has rapidly become the most popular Internet resource, combining hypertext and multimedia to provide a huge network of educational, governmental, and commercial resources. Many schools now maintain their own Web sites. Perhaps yours is one of them. Yet, because of the multimedia nature of the medium, many Internet surfers cannot access some materials available on the World Wide Web.

In the videotape presentation, *World Wide Access*, individuals with disabilities share access problems and solutions. At the end of the video, design features for making Web pages accessible are listed. These recommendations are covered in the handout titled *World Wide Access: Accessible Web*

Design. Watch the videotape and review the publication. The handout titled *Meet the Speakers in the Videotape — World Wide Access* provides information about the people featured in the videotape.

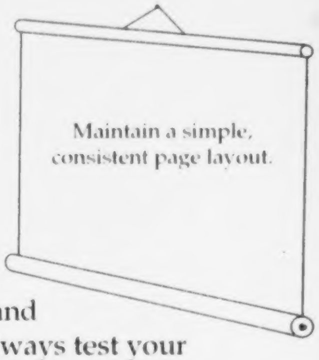
General Page Design

Let's consider the principles described in the videotape. If you have not created a Web page before, you may be confused by some of the technical jargon used. If so, don't be discouraged. Focus on the basic principles and pass the information in the handout on to staff, students, and administrators responsible for Web page development at your school. We'll start out with principles related to general page design.

The first principle to remember is to maintain a simple, consistent page layout throughout your site. Much of the power and appeal of the web comes from the fact that it presents information in a variety of formats while also organizing that information through hypertext links. Designing a well organized site with a consistent design makes it easier for visitors to find the information they need. Following this guideline will especially assist people with learning disabilities who have difficulty following disorganized presentations.

Think about the physical effort needed to use your site. Remember that small buttons marking links can be difficult targets for visitors with mobility impairments that result in restricted hand movements. Larger buttons make it easier for all visitors to select the links on your page. Along with a consistent page layout, it is important to keep backgrounds simple and make sure there is enough contrast.

People with low vision or color blindness, or those using black and white monitors can have difficulty reading information at sites with busy backgrounds and dark colors. Many background images and colors obscure text and make reading difficult. Make sure that there is enough contrast between your text and the background of the page. Choose background, text, and link colors carefully, and always test your site with both black and white and color monitors. Following this guideline will aid visitors with low vision and those with learning disabilities who can find busy backgrounds and moving features from page to page confusing.


Maintain a simple, consistent page layout.

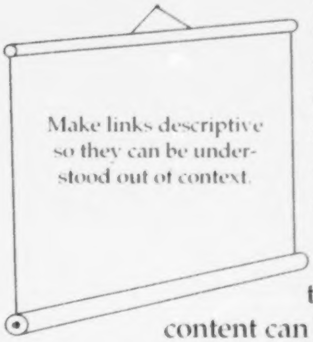
Visitors who use screen reading software can adjust their software to read only the links on a page. For this reason, links should provide enough information when read out of context. For example, never use "click here" as a link, or next to a graphic used as a link. Make links descriptive enough so that they are understood out of context.

Hypertext Markup Language (HTML) is the standardized code used to create Web sites. The code works with tags that tell a Web browser where to find and how to display your information. HTML was designed to be a universal format outside the bounds of proprietary software and computer languages. The World Wide Web Consortium (W3C) specifies what is standard HTML with the intent of maintaining a language

Keep backgrounds simple with enough contrast.

compatible with many platforms and browsers.

The universal format of the World Wide Web meets the equitable and flexible principles of universal design. However, many people like to add new and non-standard features to add flash to their Web pages. This obstructs the original purpose of a world-wide standard and the open communication that it allows and encourages.


Make links descriptive so they can be understood out of context.

Using standard HTML tags will ensure that your content can be accessed by all browsers used by visitors to your site. Avoid tags, such as <BLINK> that are not supported by all Web browsers. Another example of non-standard tags are frame tags. Frames often present logistical nightmares to text-based screen reading software. Evaluate whether frames are truly necessary at your site. When you use non-standard tags, you are likely blocking someone from your information.

Notify your users that you are concerned about accessibility by including a statement about accessibility on your page. Encourage site visitors to notify you with their accessibility concerns. For example, the DO-IT home page includes this statement:

Use Standard HTML.

> *The DO-IT pages form a living document and are regularly updated. We strive to make them universally accessible. You will notice that we minimize the use of graphics and photos, and provide descriptions of them when they are included. Video clips are open captioned, providing access to users who can't hear the audio. Suggestions for increasing the accessibility of these pages are welcome.*

Graphical Features

People who are blind cannot view the graphical features of your Web site. Many people with visual impairments use voice output programs with text-based browsers (such as Lynx) or graphical browsers with the feature that loads images turned off. Include text alternatives to make the content in these graphical features accessible. This addresses the universal design principle of redundant presentation of information in different modes.

Some people have advocated the use of alternative text versions of Web sites that are graphic-intensive. However, this adds a great deal of maintenance time and complexity as two versions must be updated. The maintenance time increases exponentially for organizations that are required, or that choose to provide their sites in multiple language versions. Make every effort to create the original version in an accessible format. Remember, the first principle of universal access is equitable use, so avoid segregating users of your electronic resources based on their ability, connection speed, or type of hardware and software they use. Below are guidelines for providing alternative text for various types of visual features.

Include a note about accessibility.

To start out, always include short, descriptive ALT attributes for graphical features on your page. What is an ALT attribute? An ALT attribute is an HTML code used with the IMG tag that is used to give alternative text information for graphical features. The alternative text helps the visitor understand what is on the page even if they are using a text browser or if they have image loading turned off in their graphical browser.

Provide text alternatives.

The bolded text in the following example of HTML code shows what an ALT attribute looks like. An ALT attribute always works within an image or graphical HTML tag.

```
<HTML>
<HEAD>
<TITLE>DO-IT Program</TITLE></
HEAD>
<BODY><IMG SRC="./doitlogo.large.gif"
ALIGN=MIDDLE ALT="[DO-IT LOGO]">
<H1>DO-IT at the University of Washing-
ton</H1>
```

In some cases where a graphic provides no additional information, the ALT attribute can be used with a null value ("") to eliminate clutter. ALT attributes for graphical bullets can simply be asterisks.

```
<IMG SRC="./dec.gif" ALIGN=MIDDLE
ALT="">
<IMG SRC="./bullet.gif" ALIGN=MIDDLE
ALT="*">
```

For example, when a sighted visitor views the DO-IT home page at *http://weber.u.washington.edu/~doit/* with a graphical browser, he will see the DO-IT logo.

When a user who is blind visits, his voice output program will read [DO-IT LOGO] because DO-IT staff used this text as an ALT attribute for the graphic. This gives him a clear idea of what is on the page. In addition, any visitor coming to the site using a text-based browser will understand that there is a logo there instead of the more ambiguous "image" that is the default result when no ALT attribute is used. ALT attributes should be short and simple (less than five words) as browsers sometimes have difficulty with long ALT attributes.

This example can also be used to explain the difference between text and words embedded in a graphic. Web designers sometimes embed text in graphics so that they can incorporate color, fancy fonts, and other design elements into the display. It is important to differentiate between text, which screen readers can access, and words that are images, which screen readers cannot read. In the DO-IT logo, "DO-IT" is a graphic image. DO-IT staff includes "DO-IT" in the ALT attribute so that the DO-IT name is displayed by a text browser and thus read by a speech synthesizer.

Another principle of universal design is to use menu alternatives for image maps (also called ISMAPS) to ensure that the embedded links are accessible. An image map is a picture on which parts of the picture can be clicked to find a link to another page. For example, a site with information on state trivia presents a map of the United States. A visitor can click on Washington to find out the state bird, song, insect, flower, and other facts. But if the Web page developer has not included an alternative menu, visitors using text-based browsers can be totally blocked from the site, or sent on a wild goose chase clicking unlabeled links that lead them in circles.

The HTML coding in this example does not include an alternative menu for the image map.

```
<HTML>
<HEAD>
<TITLE>States Trivia</TITLE>
</HEAD>
<BODY>
<A HREF="images/home.map">
<IMG SRC="images/states.jpg"ismap></A>
</BODY>
</HTML>
```

When viewed through a graphical browser, such as Netscape, a picture of a map of the United States appears and the visitor can choose information by state. But, when a visitor using a text-based browser visits the site, what he sees is this:

```
States Trivia
[ISMAP]
```

At this point the visitor is stuck as text-based browsers will not interpret the hypertext links embedded in the image map. His only option is to back out of the site. A visitor who uses a text-based browser, perhaps because he is blind, cannot get to your information.

The accessibility of image maps is dependent on the server software used at a Web page site. If ALT attributes are included for every hyperlink in an image map, some server programs can pull the hyperlink information from the image map and present it in menu format for text-based browsers. However, many Web servers do not have this capability. If this support is not available to you, you can always make the image map accessible by adding a separate navigation menu, or listing of hypertext links, above or below the image map.

Using ALT attributes and alternative menus help all of your visitors navigate through your site. The next principles we will discuss help your visitors understand the content in non-text, graphical features on your page. Including ALT attributes is sufficient for logos and graphics that are not critical to the information content of the page. But if the graphics provide information beyond this, adding captions and transcriptions is important for those who cannot see your page because they are using a text-based browser possibly because they are blind. Include descriptive captions for photographs and pictures. Describe images in enough detail so that a visitor who cannot see the pictures will understand the content that they add to the page.

If you present information in an image format, such as a scanned-in image of a page of a manuscript, be sure to also include a transcription of the manuscript in a straight text format. Remember, words embedded in an image are not accessible to those using a voice output systems. This aids a wide variety of visitors including those with visual impairments, users who speak English as a second language, and those with learning disabilities. Again, think redundancy.

Multi-media and audio formats can present barriers to people with hearing impairments as well as for people with less sophisticated computer systems. Provide captioning and transcriptions for spoken materials so these visitors have an alternative method of accessing this information.

Special Features

Most screen reader programs read from left to right, jumbling the meaning of information in tables. Some adaptive technology can deal with format issues such as this, but it is best to look for other ways to present the information so that visitors with visual impairments can read your data. Consider using an alternative format for information that might be included in a table.

Use special features such as forms, data-bases and plug-ins with care. Always test forms and databases with a text-based browser. Include an electronic mail address and other contact information for those who cannot use the form or database.

Use features that require plug-ins, mini programs that run within a browser, with care. Not all people have the high-end equipment needed to download and run plug-ins. In addition, content presented using plug-ins and are not accessible through text-based Web browsers. As the software is developed, applets (such programs created with JAVA) and plug-ins (such as Adobe Acrobat) may provide adequate accessibility features. However, to ensure that people with visual and hearing impairments can access your information, provide the content from these programs in other, text-based formats.

Web Page Test

The final guideline is to test your Web pages with as many Web browsers as you can. Always use at least one text-based browser. This way, you will see your Web resources from the many perspectives of your users.

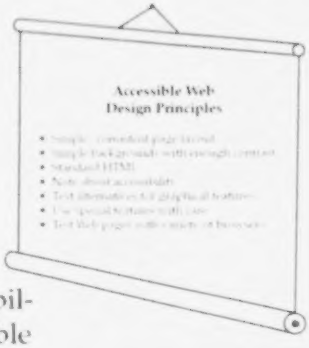
Part of testing your Web site includes running it against an HTML validator program. These programs compare the HTML at your site with the rules of standard HTML. They then provide a report listing errors and non-standard tags. Some validators check specifically for accessibility. Try using an accessibility validation site which performs a diagnostic on your pages and points out parts that could be inaccessible. For example, Bobby is an easy-to-use program to find HTML compatibility problems that prevent pages from displaying correctly on different Web browsers. Bobby specifically highlights accessibility problems. Bobby was created at CAST (Center for Applied Special Technology). Its URL is *http://www.cast.org/bobby*.

Summary

Whether you are developing electronic resources or designing a lab for your school, apply universal design principles to maximize access. In particular, consider these accessible Web design principles when developing the school's Web pages.

- Maintain a simple, consistent page layout.
- Keep backgrounds simple. Make sure there is enough contrast.

- Use standard HTML.
- Include a note about accessibility.
- Provide text alternatives (ALT attributes, captions, alternative menus, transcriptions) for graphical features.
- Test and use special features with care.
- Test your Web pages with a variety of browsers.



Schools have a moral and legal responsibility to make computing resources accessible to students with disabilities. They must provide accessible buildings, computers, and electronic resources. You should also demand from vendors that products you purchase employ access features.

A READING LIST

Following is a list of articles and videotapes that can be used for further research and instruction in the area of computing access for students with disabilities.

Adaptive technology for people with disabilities (videotape). Washington, DC: EASI, American Association of Higher Education.

Anson, D.K. (1997). Alternative computer access: A guide to selection. Philadelphia, PA: F.A. Davis Company.

Assistive technology: A student's right. (1992). Exceptional Parent, 22(8).

Berliss J.(1994) Boon or bust? Access to electronic publishing by individuals using adaptive computer technology. Journal of the American Society for Information Science, 45(10), 753-59.

Brett, A. (1997). Assistive and adaptive technology – Supporting competence and independence in young children with disabilities. Dimensions of Early Childhood, 25(3),14-15,18-20.

Brightman, A.J., & Green, P. (1990). Independence day: Designing computer solutions for individuals with disability. Allen, TX: DLM.

Brown, C. (1993). Assistive computer technology: Opening new doorways. New Directions for Student Services, 64, 89-102.

Brown, C. (1992). Assistive technology, computers and persons with disabilities. Communications of the ACM, 35(5), 36-45.

Burger, D., Improved access to computers for the visually handicapped: New prospects and principles. (1994). IEEE Transactions on Rehabilitation Engineering, 2(3), 111-118.

Burgstahler, S.E. (1998). Making Web pages universally accessible. Computer-Mediated Communications Magazine, 5 (1).

Burgstahler, S. E. (1997). Students with disabilities and the online classroom. In Z. L. Berge and M. P. Collins (Eds.), Wired Together: The Online Classroom in K-12, Volume I. Cresskill, NJ: M. Hampton Press, Inc.

Burgstahler, S.E. (1997). Teaching on the Net: What's the difference? T. H. E. Journal, 24(9), 61-4.

Burgstahler, S.E., & Comden, D. (1997). World wide access: Focus on libraries. Journal of Information Technology and Disabilities, 4 (1-2).

Burgstahler, S.E., Comden, D., & Fraser, B. (1997). Universal access: Electronic resources in libraries - Presentation materials. Seattle, WA: DO-IT, University of Washington.

Burgstahler, S.E. (1994). Adaptive technology that provides student access to computers. The EDUTECH Report, 10 (4), 4-5.

Burkhead, E.J., McMahon, B.T., & Sampon, J.P. (1986). The liberation of disabled persons in a technological society: Access to computer technology. Rehabilitation Literature, 47(7-8), 162-168.

Castorina, C. (1994). Spreading the word about adaptive technology. Change, 26(2), 45-47.

Chalfen, D.H., & Farb, S.E. (1996). Universal access and the ADA: A disability access design specification for the new UCLA library online information system. Library Hi Tech, 14(1), 51-56.

Closing the gap 1998 resource directory. Closing the Gap, 16(6), 41-195.

Computers, technology, and people with disabilities. Washington, DC: HEATH Resource Center.

Coombs, N. (1991). Window of equal opportunity - online services and the disabled computer user. Research and Education Networking. 2(9).

Coombs, N., & Cartwright, G.P. (1994). Project EASI: Equal Access to Software and Information. Change, 26(2), 42-44.

Cunningham, C. & Coombs, N. (1997). Information access and adaptive technology. Phoenix, AZ: Orynx Press.

Deines-Jones, C. (1996). Access to library internet services for patrons with disabilities: Pragmatic considerations for developers. Library Hi Tech; 14(1), 57-64,68.

Directory of assistive technology. (1989). Reston, VA: Council for Exceptional Children, Center for Special Education Technology.

Disability-related resources on the internet. Seattle, WA: DO-IT, University of Washington.

Dixon, J. M. (1996). Leveling the road ahead: Guidelines for the creation of WWW pages accessible to blind and visually handicapped users. Library Hi Tech; 14(1), 65-68.

Equal access: Computer labs. Seattle, WA: DO-IT, University of Washington.

Equal access: Computer labs (videotape). Seattle, WA: DO-IT, University of Washington.

Filipczak, B. (1993). Adaptive technology for the disabled. Training, 30(3), 23-29.

Horne, R. (Ed.). Assistive technology. (1989) NICHCY News Digest, 13.

Holzberg, C.S. (1995). Technology in special education. Technology & Learning, 15(5), 18-23.

Hutinger, P., et al. (1996). Assistive technology applications in educational programs of children with multiple disabilities: A case study report on the state of the practice.

Journal of Special Education Technology, 13(1), 16-35.

Lazzaro, J.J. (1994). Opinion: Adaptive computing and the internet: One step forward, two steps back? Internet Research, 4(4), 2-8.

Lazzaro, J.J. (1993). Adaptive technologies for learning and work environments. Chicago, IL: American Library Association.

Lazzaro, J.J. (1993). Computers for the disabled. Byte, 18(7), 59, 61-62, 64.

McGregor, G., & Pachuski, P. (1996). Assistive technology in schools: Are teachers ready, able, and supported? Journal of Special Education Technology, 13(1), 4-15.

Opening doors: Mentoring on the internet. Seattle, WA: DO-IT, University of Washington.

Opening doors: Mentoring on the Internet (videotape). Seattle, WA: DO-IT, University of Washington.

Pesta, John. (1994). Assistive, adaptive, amazing technologies. TECHNOS, 3(2), 10-12.

Taylor, B., & Squires, P.C. (1988). Computers offer disabled persons "equal footing." O.T. Week, 4, 14.

Todis, B., & Walker, H.M. (1993). User perspectives on assistive technology in educational settings. Focus on Exceptional Children, 26 (3), 1-16.

Trace ResourceBook: Assistive technologies for communication, control & computer access. (1996-97 Edition). Madison, WI: Trace Research and Development Center.

Wobschall, R., & Lakin, C. (Eds.). (1995). Assistive technologies feature issue. IMPACT, 8(1).

Wong, M.A. (1997). Disability and the internet: Access and use as means toward greater self-advocacy. Physical Disabilities: Education and Related Services, 15(2), 23-36.

World wide access. Seattle, WA: DO-IT, University of Washington.

World wide access (videotape). Seattle, WA: DO-IT, University of Washington.

Working together: People with disabilities and computer technology. Seattle, WA: DO-IT, University of Washington.

Working together: People with disabilities and computer technology (videotape). Seattle, WA: DO-IT, University of Washington.

COMPUTING RESOURCES

There are many resources to assist you in selecting adaptive computer technology for your students and making labs and electronic resources accessible. Here are a few places to start. Refer to the *Resources* section of this notebook for additional sources of information.

AbleData
8455 Colesville Rd.
Suite 935
Silver Spring, MD 20910
800-227-0216
301-608-8998
301-608-8958 (FAX)
http://www.abledata.com/
Able Data is an extensive and dynamic database listing information on assistive technology.

Access from Adobe
http://access.adobe.com/
Adobe's Acrobat (PDF) format is being used by many Web sites to display publications. This site includes a utility for translating PDF files to HTML so they are accessible.

Adaptive Computer Technology - University of Washington
http://www.extension.washington.edu/extinfo/
Adaptive Computer Technology is a three-credit on-line course about how technology can be used by people with disabilities for greater independence, productivity, and participation in academics and careers.

Adaptive Computer Technology Center (ACT)
http://www.utoronto.ca/atrc/
The ACT Web site provides information on adaptive technology and accessible Web design.

Adapt-it
http://www.rit.edu/~easi/workshops/adaptit.html
Adapt-it is a four-week noncredit course on adaptive computing sponsored by project EASI.

Alliance for Technology Access
2175 E. Francisco Blvd. Suite L
San Rafael, CA 94901-5523
415-455-4575
415-455-0491 (TTY)
415-455-0654 (FAX)
atainfo@ataccess.org
http://www.ataccess.org/
Community technology centers that offer training and hands-on opportunities to use assistive technology.

Alliance for Technology Center
http://www.ataccess.org/
Vendors of information access technology.

Apple Computer's Worldwide Disability Solutions Group
One Infinite Loop, M/S 38-DS
Cupertino, CA 95014
800-600-7808
800-755-0601 (TTY)
http://www.apple.com/disability/
The Apple Web site provides information on adaptive technology solutions and shareware for Apple computers.

Applied Science and Engineering Laboratories
http://www.asel.udel.edu/
Augmentative and alternative communication, organizations related to assistive technology.

Assistive Technology Project
Technical Assistance Project
703-524-6686
703-524-6639 (TTY)
703-524-6630 (FAX)
http://www.resna.org/taproject/index.html
Information about programs to promote the provision of technology-related assistance for people with disabilities are funded by the 1988 Technology-related Assistance Act and its 1993 amendments.

Assistive Technology On-Line Home Page
http://www.asel.udel.edu/at-online/assistive.html
Augmentative & alternative communication; organizations related to assistive technology.

Best Viewed With Any Browser
http://www.anybrowser.org/campaign/
This site links to resources discussing different browsers' levels of support for various versions of html.

Bobby at the Center for Applied Special Technology
http://www.cast.org/bobby/
Bobby is an HTML validator program used to find compatibility problems that prevent pages from displaying correctly with various Web browser programs.

Blind-DEV
Blind-DEV is a discussion list that is dedicated to the discussion of issues concerning the development of computer products and adaptive equipment for blind and visually impaired computer users. To subscribe, send a message with a blank subject line to *listserv@maelstrom.stjohns.edu*. In the body of the message type "subscribe blind-dev Firstname Lastname."

Center on Information Technology Accommodation (CITA)
General Services Administration
http://www.itpolicy.gsa.gov/cita/front.htm
CITA's manual, Managing Information Resources for Accessibility, available at their Web site, covers policy issues and practical concerns for information accessibility to accommodate users with disabilities.

Center for Information Technology Accommodation (CITA)
IT Accommodation Division
PWA Room 1234
1800 F Street NW
Washington, DC 20405
202-501-4916
202-501-2010 (TTY)
202-501-6269 (FAX)
Technology assistance for school-to-work; equity and access.

Center for Rehabilitation Technology
(800) 726-9119
Technology for rehabilitation.

Center for Special Education Technology
(800) 873-8255
Technology used in special education.

Closing the Gap
PO Box 68
526 Main Street
Henderson, MN 56044
507-248-3294
507-248-3810 (FAX)
info@closingthegap.com
http://www.closingthegap.com/

Closing the Gap sponsors an annual conference and publishes a resource directory and newsletter on adaptive technology.

The Council for Exceptional Children Technology and Media Group
The Council for Exceptional Children
1920 Association Drive
Reston, VA 20191-1589
703-620-3660
703-264-9446 (TTY)
703-264-9494 (FAX)
cec@cec.sped.org
http://www.cec.sped.org/

Provides support for classroom teachers and holds an annual conference to promote the availability and effective use of technology and media for students with disabilities.

CPB/WGBH National Center for Accessible Media
125 Western Ave
Boston, MA 02134
617-492-9258
617-782-2155 (FAX)
ncam@wgbh.org
http://www.wgbh.org/ncam/

Making media accessible.

Crt-focus

Crt-focus is for discussion of assistive technology for people with disabilities. To subscribe, send a message with a blank subject line to *listproc@smash.gatech.edu*. In the body of the message type "subscribe crt-focus Firstname Lastname."

DO-IT (Disabilities, Opportunities, Internetworking, and Technology)
Box 354842
University of Washington
Seattle, WA 98195-4842
206-221-4171 (FAX)
206-685-DOIT (voice/TTY)
888-972-DOIT (voice/TTY) Washington, outside Seattle
509-328-9331 (voice/TTY) Spokane office
doit@u.washington.edu
http://www.washington.edu/doit/

DO-IT maintains a useful collection of materials and links to resources on adaptive technology and accessible Web design.

Foundation for Science and Disability (FSD)
236 Grand Street
Morgantown, WV 26505-7509
304-293-5201, Ext. 513
304-343-6812 (FAX)

Liberating people with disabilities through adaptive technologies
http://interwork.sdsu.edu/ablenet/cre.html

Information about adaptive technology.

Lynx-Me
http://ugweb.cs.ualberta.ca/~gerald/lynx-me.cgi

Lynx Me will show you what your Web page will look like in Lynx, the most popular text- based Web browser.

National Center for Accessible Media (NCAM)
http://www.wgbh.org/wgbh/index.html
Sponsored by WGBH radio in Boston, NCAM promotes the use of a Web access symbol, provides model examples of accessible pages, and undertakes projects on captioning and audio description on the Web.

Raised Dot
http://www.rdcbraille.com/
Assistive technology for the blind.

Starling Access Services
http://www.starlingweb.com/acc/actoc.htm
Starling provides an accessible Web page design manual at their site.

Trace Research and Development Center
University of Wisconsin-Madison
S-151 Waisman Center
1500 Highland Avenue
Madison, WI 53705-2280
608-262-6966
608-263-5408 (TTY)
608-262-8848 (FAX)
info@trace.wisc.edu
http://www.trace.wisc.edu/
The Trace Center is an interdisciplinary research development and resource center on technology and disability located at the University of Wisconsin-Madison. Its Web site is an excellent resource on adaptive technology and universal design.

Technology and Assistive Technology
http://www.aed.org/us/disable.html

Speech Friendly Search Engines
http://www.savh.org.sg/search.htm
For people who search the Internet using speech synthesis.

Uaccess-l
Uaccess-l is for discussion of universal access to information systems. To subscribe, send a message with a blank subject line to listproc@trace.wisc.edu. In the body of the message type "subscribe uaccess-l Firstname Lastname."

WebABLE
http://www.webable.com/
WebABLE maintains a searchable directory for disability-related Internet resources.

The World Wide Web Consortium (W3C) Web Accessibility Initiative (WAI)
http://www.w3.org/WAI/
The W3C develops standards for the evolution of the World Wide Web.

Videotape Presentation:

- *Working Together: Science Teachers and Students with Disabilities*

Handouts:

- Working Together: Science Teachers and Students with Disabilities
- Meet the Speakers in the Videotape — Working Together: Science Teachers and Students with Disabilities

As scientific fields make increasing use of technology, new opportunities emerge for people with a variety of abilities. When students with disabilities and science teachers form learning partnerships, the possibilities for academic and career success multiply.

The information provided in this section will provide you with specific strategies and tools for assuring access to all students, including those with disabilities, in your science and math classes. It is organized as follows:

General Guidelines
  Gaining Knowledge
  Demonstrating Knowledge
  One Math Teacher's Experiences
  One Science Teacher's Experiences

Four-Step Accommodation Model

Student Abilities Profile
  Examples
  One Science Teacher's Experience with the *Four-Step Model* and the *Student Abilities Profile*

Some students with disabilities have conditions that are invisible; some are visible. Since each person's situation is unique, the best solutions for maximizing participation come about when the student and teacher work together to develop creative alternatives for challenges faced by students with disabilities. Such challenges include gaining knowledge and demonstrating knowledge. In most cases, it takes just a little creativity, patience, and common sense to make it possible for everyone to learn and contribute. Review the videotape presentation and handouts titled *Working Together: Science Teachers and Students with Disabilities*. To learn more about the experts who developed these materials, read the handout *Meet the Speakers on the Videotape — Working together: Science Teachers and Students with Disabilities.*

Gaining Knowledge

Many students with disabilities face challenges to gaining knowledge. Examples of specific challenges and accommodations follow.

A student who has difficulty reading standard text or graphics due to a visual impairment can be accommodated by providing materials in large print or Braille, on tape, or via computer; enlarged or tactile drawings; and access to adaptive technology that provides enlarged, voice, and/or Braille output.

A student who cannot see materials on the blackboard or overhead projector due to a visual impairment may benefit from using binoculars. Verbalization of the content and oral descriptions of all visually displayed materials is also helpful.

A student who cannot read output from standard equipment because of a visual impairment may benefit when the teacher interfaces lab equipment with a computer and provides large print and/or speech output. Scientific equipment with Braille or large print markings will help maximize the participation of a student who is blind or has low vision.

A student who cannot hear presentations and instructions may use an AM/FM system or an interpreter. Providing materials in printed materials, facing a student for lip reading, and using an overhead projector or blackboard can also be appropriate accommodations for a specific student.

For a student who cannot hear multimedia and videotaped presentations, make sure that such presentations are captioned and/or an interpreter is provided.

A student who has difficulty participating in class discussions due to a hearing and/or speech impairment may benefit from using electronic communications (e.g., via the Internet) where the ability to hear or speak is not required. A portable computer with speech output can provide a person without the ability to speak a tool for communication with others.

A student who cannot understand concepts due to a specific learning disability may benefit when visual, aural, and tactile demonstrations are incorporated into instruction. Provide a student who has difficulties reading because of a specific learning disability extra time and access to materials via a computer equipped with speech and/or large print output and Internet access.

When a student cannot take notes in class because of a mobility or visual impairment, provide in-class access to a computer with adaptive technology and a word processor. A student who cannot operate lab equipment and conduct lab experiments due to a mobility impairment should be provided with an accessible facility. Also consider providing a lab partner or scribe; computer controlled lab equipment with alternative input devices (e.g., speech, Morse code, alternative keyboard); and modified scientific equipment.

For a student who cannot see demonstrations or view lab experiments while seated in a wheelchair, provide an adjustable table and an alternative seating arrangement.

If a student cannot complete an assignment or lab because of a health impairment, arrange a flexible lab schedule.

For a student who has difficulty conducting research because of a disability, make information accessible on a computer (e.g., CD-ROM, disk, Internet) with adaptive technology.

Demonstrating Knowledge

Some students with disabilities cannot demonstrate mastery of a subject by writing, speaking, or by working through a problem in a lab. Many of the accommodations for gaining knowledge can help the student demonstrate mastery of a subject as well. Examples of other accommodations follow.

The student who has difficulty completing and submitting worksheets and tests because of a visual impairment and/or specific learning disability can be accommodated by worksheets and tests in large print or Braille, on tape, or via computer and access to adaptive technology that provides enlarged, voice and/or Braille as well as standard print output.

A student who cannot complete a test or assignment because of a disability that affects the speed at which the task can be completed may require extra time or alternative testing arrangements. A student who cannot complete a test or assignment because of the inability to write may benefit from in-class access to a computer with alternative native input (e.g., Morse code, speech, alternative keyboard) devices.

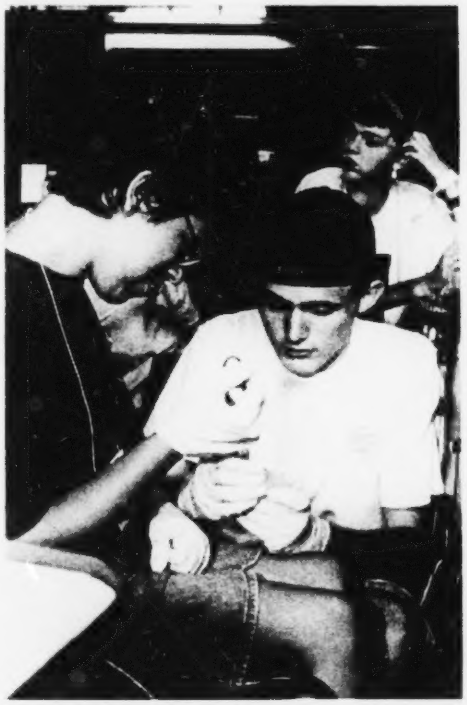
One Math Teacher's Experiences

Each fall Cherie Smith, mathematics teacher at Mount Rainier High School in Washington state, looks forward to meeting new students. While mathematics is challenging for many students, it is exciting for her to watch young people solve problems and gain new skills in her classroom. Over the past ten years, however, she has noticed that many students do not have access to successful experiences that lead to and promote excellence in math. These students have special needs that are often overlooked in the regular classroom. They may have physical, learning, visual, hearing, or other types of disabilities that affect their ability to learn without some type of accommodation in the classroom.

Meeting individual needs effectively, while serving all of the 150-180 students with whom an average high school comes in contact each day, is difficult and creates a constant balancing act. However, Cherie has found that some strategies increase the performance of ALL of her students in mathematics while addressing the unique needs of those with disabilities. Some specific accommodations are particularly effective for students with Attention Deficit Disorder and/or specific learning disabilities. Here are a few of her most commonly used "tricks of the trade."

- Don't make assumptions about what the student can or cannot do. They almost invariably have more capabilities than the teacher asks for!
- Talk to the student in private about learning styles and classroom arrangements that have worked for them in the past.
- Dimming the lights when working on the overhead helps students direct their attention and focus on what's most important.
- Seat a student with ADD near the teacher's desk and away from windows where outside activities may cause a distraction.
- Watch for the effects of white noise (air conditioners, fans, buzzing lights). Modify the layout of the room or move the student's desk to appropriately accommodate this concern.
- Encourage peer tutoring and cooperative learning situations.
- Encourage on-task behavior.
- Have pre-established consequences for behavior and stick to your rules.
- Avoid ridicule and criticism.
- Ask the family to make arrangements at home to accommodate their child. For example, they could provide a regular area to study that is free of distractions.
- Calling on students can be very disorienting and embarrassing for some students with specific learning disabilities. Letting them know ahead of time that you are going to be asking them a question in front of the group allows them to collect their thoughts.
- Provide copies of your lecture notes and outlines to some students who may have trouble following a lecture. They can add to the notes with their comments. This is also helpful for students who have difficulty writing.
- Be an actor and use props in class to get a point across.

- Keep oral instructions logical and to the point. The teacher must keep on task too!
- Repeat instructions and ask the class to repeat the instructions to you.
- Write new mathematics terms on the blackboard.
- Have students underline and discuss at the next class session words they do not understand fully.
- Give assignments in written and oral forms.
- Give several days (with time for questions or feedback) for complex out-of-class assignments.



Above all, accommodating individual needs in Cherie's mathematics classroom sets a tone for the year that honors individual effort and values everyone. Students who respect each others' contributions in the classroom not only learn more mathematics, but learn valuable lessons about what makes them better people.

One Science Teacher's Experiences

To demonstrate the wide variety of accommodations that might be appropriate, let's imagine that a student who is blind enrolls in your science class. To gain some ideas for accommodating this student in a wide variety of science labs, you contact Mr. Alan Roth, a member of the DO-IT MATH-SCI project team. Mr. Roth makes the following recommendations based on his wealth of experiences teaching science to blind students.

The first question you should ask yourself is, "How do I provide this student with a quality educational program?" Although he will need some accommodations, your good teaching skills, with some modifications, will serve this blind student well.

Your school district may have an itinerant teacher who works specifically with students who have visual impairments. These professionals can provide additional resources, three-dimensional models and/or Brailled materials.

Regarding room logistics, ask the student where the best place is for him to sit. He will provide you with his insights on seating arrangements, and other strategies that have worked in the past. Remember, he is, or should be, becoming an expert on his disability and accommodation needs.

Modifications in the classroom should include tactile drawings or graphs, three-dimensional models, and a lot of hands-on learning. An example of an inexpensive solution is to buy fabric paint or get a glue gun to make raised drawings. Keep these drawings simple and free of clutter or they will confuse rather than help. Try them yourself.

A student who is blind may require Brailled text. Work with the special services in your district to make arrangements to have materials Brailled. A tape recorder can also be used to give information to a blind student.

Some videos are available with an audio description option for visually impaired viewers. If you show other movies or videos, verbally describe the action.

Always be sure to include a blind student in all class discussions and hands-on experiences. Participation will give the student confidence and opportunities to work closely with his sighted classmates.

Below are some specific examples of how Mr. Roth has accommodated blind students in his science classroom.

- Make a tactile syringe by cutting notches in the plunger at 5 ml. increments.
- Make a triple beam balance tactile, by filing deep notches for each gram increment. Add glue drops on either side of the balance line so that the student will know when the weights are balanced.
- Make graphs tactile by using glue sticks or fabric paint.
- Braille labels with Dymo Labeler.
- Identify increments of temperature on a stove using fabric paint.
- Use different textures like sandpaper or yarn to identify drawers, cabinets, and equipment areas.
- Make models out of clay, plaster of Paris or paper mache.
- For geometric shapes use 3D triangles or spheres.
- For maximum hands-on experiences, use a pegboard with golf tees and rubber bands to draw shapes or develop spatial awareness.
- Use Styrofoam and toothpicks or molecular kits to show atoms and molecules.
- For a measurement tool use staples on a meter stick to label centimeters.
- When measuring liquids, have glassware with specific measurements or make a tactile graduated cylinder.
- Use a cork borer to make a Styrofoam, three-dimensional circle. Cut out a plastic strip used to identify plants. Cut out notches at 5 ml. increments. Put a notch in the Styrofoam circle and glue the plastic strip in. When water is put in the cylinder, the Styrofoam will float upwards and your student can use touch to measure the liquid. This method does not work when using acids.

These examples demonstrate that inexpensive supplies used creatively and a commitment to the full participation of all students can make the experiences of a blind student in your class a positive one.

FOUR-STEP ACCOMMODATION MODEL

Videotape Presentation:

- *The Winning Equation: Access + Attitude = Success in Math and Science*

Handout:

- *The Winning Equation: Access + Attitude = Success in Math and Science*

View the videotape presentation and handout. The DO-IT MATH-SCI project has developed a *Four-Step Accommodation Model* for creating effective accommodations in science and math classes. It involves answering the questions in the following four steps:

Step #1: What does the task or assignment require?

This step asks you to break down ALL of the components of the experiment, assignment or exercise. Many times as an educator, you are too close to the project to realize the various settings, tools, skills, and tasks that are required in an individual project. By analyzing and evaluating the task thoroughly you will be able to determine how best to fully and effectively include a student with a disability.

Step #2: What physical, sensory, and cognitive skills are needed?

This step requires you to compare the tasks required to the physical, sensory, and cognitive skills needed to successfully complete the project. It is easy to say, "If I had a physical, sensory, or cognitive disability I would not be able to successfully complete this assignment," without really determining what skills are needed. Separate the "real" requirements of the task from the "fictional or perceived" aspects of the project. It is impossible to place yourself in the shoes of the student with a disability. The student may have learned many ways to solve a unique problem or task and work around the limitations his disability may pose to him.

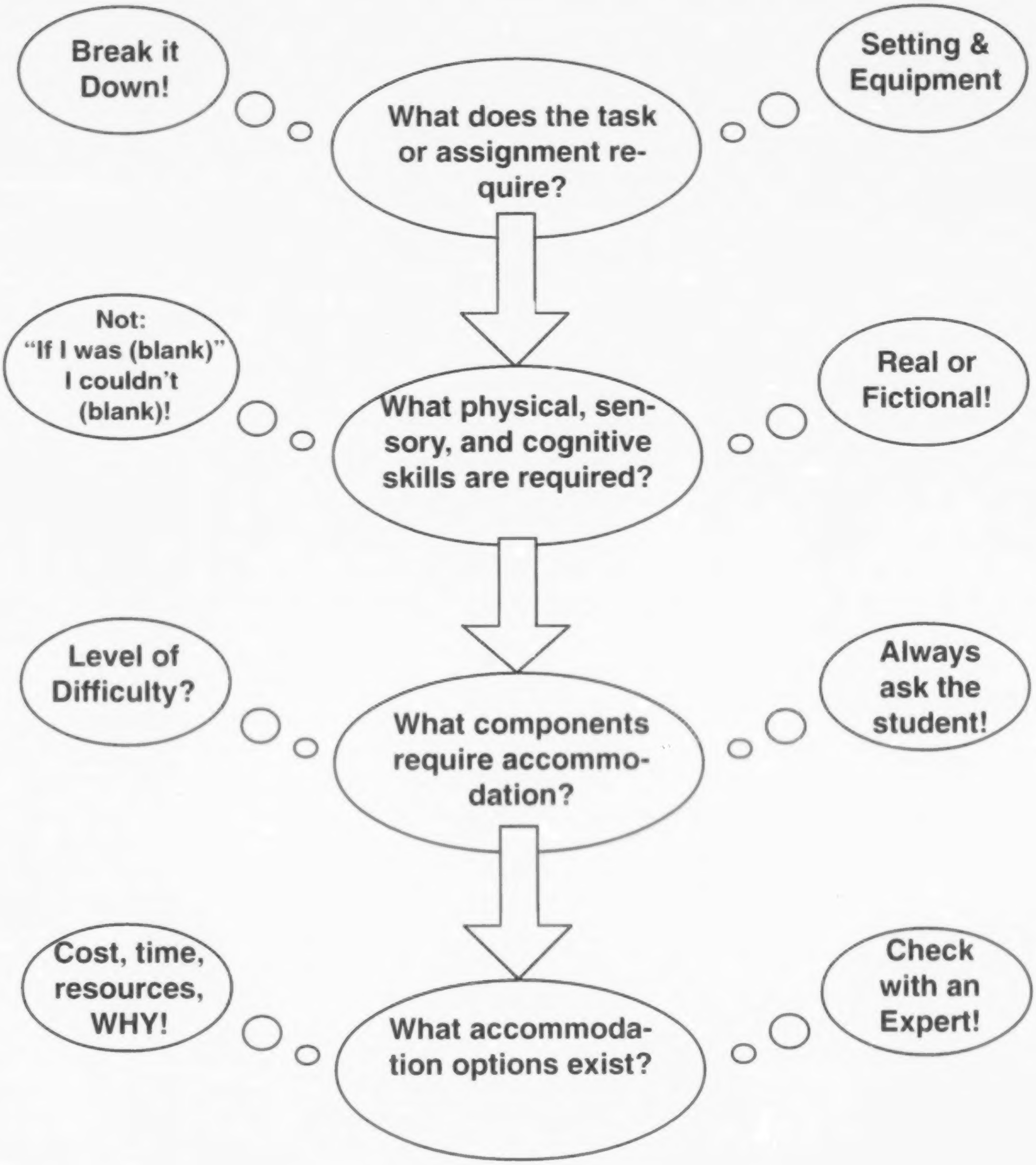
Step #3: What components of the task require accommodation?

Once the task has been analyzed and the skills needed are identified, step 3 asks you to determine what accommodations may be needed. Here you determine the level of difficulty of the project and determine how best to make an accommodation to create an inclusive environment for a student with a disability. It is very important to first check with the student to determine what they perceive as aspects of a project in which they may need an accommodation or assistance.

Step #4: What accommodation options exist?

Now that the tasks that need accommodation have been determined identify what resources exist for providing the needed accommodation. This is a time when other staff and professionals who have expertise in a specific area can be called on to provide input. The cost and time required for the accommodation are variables that may also be weighed in determining an effective accommodation. Use the most readily available resources in making accommodations.

Four-Step Accommodation Model


Break it Down!
What does the task or assignment require?
Setting & Equipment
Not: "If I was (blank)" I couldn't (blank)!
What physical, sensory, and cognitive skills are required?
Real or Fictional!
Level of Difficulty?
What components require accommodation?
Always ask the student!
Cost, time, resources, WHY!
What accommodation options exist?
Check with an Expert!

STUDENT ABILITIES PROFILE

Following is the *Student Abilities Profile* form designed to guide you in determining a student's skills and abilities as well as assisting you in breaking down the individual components of a science or mathematics assignment. The form asks you to briefly describe the student, the classroom or laboratory environment, equipment or supplies needed, available professional and external resources, possible accomodations and the physical, sensory, and cognitive skills needed for the task.

STUDENT ABILITIES PROFILE

DO-IT

Narrative:

Task / Assignment:

Equipment: (Lab equipment, protective clothing, chemicals)

Environment: (fumes, odors, dust, temperature, noise, group-work)

Physical Challenges	**Accommodations Needed**	**Options and Resources**
Sensory Challenges	**Accommodations Needed**	**Options and Resources**
Cognitive Challenges	**Accommodations Needed**	**Options and Resources**

Physical Issues	Sensory Issues	Cognitive Issues
Think of the required physical aspects of the task. What will make the environment accessible, keep the student safe and allow him/her to be an active participant? What lab equipment must be manipulated?	Think of room temperature, noise, fumes, dust, odors, allergies. Also consider the ability to speak and/or communicate, and the visual aspects of the task or assignment.	Is the assignment done with a group, partner or individually? What memory & communication skills are needed? What is the level of complexity of the task.
Physical Challenges	**Sensory Challenges**	**Cognitive Challenges**
1. lift / carry 2. stamina / endurance 3. push / pull 4. knee / squat 5. reach 6. repetitive tasks 7. fine motor: pinch / grasp 8. fine motor: manipulate / maneuver 9. gross motor 10. sit in chair 11. walk / stand 12. balance 13. bend / twist 14. stoop / crouch 15. other	1. vision 2. hearing 3. touch 4. smell 5. taste 6. oral communication 7. temperature 8. fumes 9. external stimuli 10. lighting 11. other	1. short term memory 2. long term memory 3. task complexity 4. reading 5. writing 6. spelling 7. string of numbers (math) 8. paying attention 9. visual, auditory, or kinesthetic learner. 10. self-esteem / advocacy issues 11. behavior issues / acting out 12. other

Rebecca C.

STUDENT ABILITIES PROFILE

Narrative:

Rebecca is a 15 year old freshman. She has a physical condition which affects both her motor and cognitive skills. She is very personable but takes a long time to grasp even simple concepts. She hates to make mistakes. She needs auditory input and may need instructions repeated numerous times. Labs must be slow paced with as few steps as possible. She needs assistance with manipulatives.

Task / Assignment:

Actively participating in science classroom and lab experiences, including on-site field trips.

Equipment: (Lab equipment, protective clothing, chemicals)

Environment: (fumes, odors, dust, temperature, noise, group-work)

Physical Challenges 6. Difficulty with repetitive tasks. 7. Fine motor skills: difficulty pinching and grasping. 11. Difficulty walking and standing.	**Accommodations Needed** • Provide hand-over-hand guidance. • Provide classes that are in close proximity to each other. • Provide a "grabber" device and surgical gloves to increase ability to grasp. Avoid small manipulatives. • Provide a work station that is low enough and accessible for a wheelchair. • Reduce length of assignment / tasks. • Provide air-conditioned environment to reduce fatigue. • Provide lab equipment with easy to grasp handles. • Provide a responsible lab partner.	**Options and Resources** • Obtain curriculum suggestions from Special Education teacher and / or physical therapist. • Get information on lift-equipped vans from district. • Get information on accessible lab furniture and equipment from local vendor. • Purchase word recognition software or other adaptive computer technology. • Talk with the student about accommodations.
Sensory Challenges None.	**Accommodations Needed** None.	**Options and Resources** Not applicable.
Cognitive Challenges 1. Limited short term memory. 2. Limited long term memory. 3. Has difficulty with complex tasks. 4. Reading limitations. 5. Writing limitations. 6. Spelling is poor.	**Accommodations Needed** • Shorten reading time and procedure for labs to avoid fatigue. • Provide tape-recorded texts. • Remind Rebecca of assignment periodically. • Be patient and allow extra time for testing. • Break assignments into small, linear steps. • Speak slowly and distinctly. • Provide clear, simple verbal descriptions. • Avoid loud noises. • Repeat instructions periodically auditorily.	**Options and Resources** • Consult with Special Education Teacher, doctor, and / or parents. • Avoid complex lab experiments; break complex tasks into small steps. • Maintain class order and have students talk in turn. • Provide peer partner to assist with instructions; have partner sit close and use a soft voice. • Give information over several days. • Talk with student about alternative accommodations.

Physical, Sensory, & Cognitive Issues and Challenges

Physical Issues	**Sensory Issues**	**Cognitive Issues**
Think of the required physical aspects of the task. What will make the environment accessible, keep the student safe and allow him/her to be an active participant? What lab equipment must be manipulated?	Think of room temperature, noise, fumes, dust, odors, allergies. Also consider the ability to speak and/or communicate, and the visual aspects of the task or assignment.	Is the assignment done with a group, partner or individually? What memory & communication skills are needed? What is the level of complexity of the task.
Physical Challenges	**Sensory Challenges**	**Cognitive Challenges**
1. lift / carry	1. vision	1. short term memory
2. stamina / endurance	2. hearing	2. long term memory
3. push / pull	3. touch	3. task complexity
4. knee / squat	4. smell	4. reading
5. reach	5. taste	5. writing
6. repetitive tasks	6. oral communication	6. spelling
7. fine motor: pinch / grasp	7. temperature	7. string of numbers (math)
8. fine motor: manipulate / maneuver	8. fumes	8. paying attention
9. gross motor	9. external stimuli	9. visual, auditory, or kinesthetic learner.
10. sit in chair	10. lighting	10. self-esteem / advocacy issues
11. walk / stand	11. other	11. behavior issues / acting out
12. balance		12. other
13. bend / twist		
14. stoop / crouch		
15. other		

William R.

STUDENT ABILITIES PROFILE

Narrative:

William is an 18 year old senior who has Tourette's Syndrome. He exhibits frequent and inappropriate loud verbalizations during class. William is an athlete. He plays football. He is 6' 3" tall and weighs over 200 pounds. His presence can be intimidating. He is being medicated for his condition. He may use his disability to avoid work. He can be manipulative. His parents are divorced with many family issues, and are hostile towards the school district. His peers tolerate his outbursts and tend to cover for him. It is important to note that outbursts and tics may affect the entire classroom atmosphere.

Task / Assignment:

Algebra class.

Equipment: (Lab equipment, protective clothing, chemicals)

Hold William's attention when instructing the class. May need to repeat instructions directly to him. This is especially true of safety procedures.

Environment: (fumes, odors, dust, temperature, noise, group-work)

Group work may be distracting to William. Check progress frequently.

Physical Challenges 15. Other: Constant verbal outbursts	**Accommodations Needed** • Don't react to negative outbursts or single him out; explain Tourette's syndrome to class as appropriate. • Reduce stress as much as possible.	**Options and Resources** • Consult Special Education teacher. • Talk with student about classroom options he might prefer.
Sensory Challenges None.	**Accommodations Needed** None.	**Options and Resources** Not applicable.
Cognitive Challenges 8. Other: Easily distracted; difficulty paying attention.	**Accommodations Needed** • Allow him to take exams in a quiet location with a proctor.	**Options and Resources** • Talk to student about strategies that will help him pay attention.

Physical, Sensory, & Cognitive Issues and Challenges

Physical Issues	Sensory Issues	Cognitive Issues
Think of the required physical aspects of the task. What will make the environment accessible, keep the student safe and allow him/her to be an active participant? What lab equipment must be manipulated?	Think of room temperature, noise, fumes, dust, odors, allergies. Also consider the ability to speak and/or communicate, and the visual aspects of the task or assignment.	Is the assignment done with a group, partner or individually? What memory & communication skills are needed? What is the level of complexity of the task.
Physical Challenges	**Sensory Challenges**	**Cognitive Challenges**
1. lift / carry 2. stamina / endurance 3. push / pull 4. knee / squat 5. reach 6. repetitive tasks 7. fine motor: pinch / grasp 8. fine motor: manipulate / maneuver 9. gross motor 10. sit in chair 11. walk / stand 12. balance 13. bend / twist 14. stoop / crouch 15. other	1. vision 2. hearing 3. touch 4. smell 5. taste 6. oral communication 7. temperature 8. fumes 9. external stimuli 10. lighting 11. other	1. short term memory 2. long term memory 3. task complexity 4. reading 5. writing 6. spelling 7. string of numbers (math) 8. paying attention 9. visual, auditory, or kinesthetic learner. 10. self-esteem / advocacy issues 11. behavior issues / acting out 12. other

Rocky R.

STUDENT ABILITIES PROFILE

DO-IT

Narrative:

Rocky is an 18 year old junior. He is outgoing, tells funny jokes and likes to tease the other students in his class. He likes to work without much assistance and is independent except for lab classes. Special effort should be placed on providing a good room orientation as Rocky is blind and uses a cane for mobility. He reads Braille. He is sensitive to references about his blindness. Self advocacy and self-esteem issues should also be addressed.

Task / Assignment:

Actively participating in science classroom and lab experiences, including doing lab manipulations.

Equipment: (Lab equipment, protective clothing, chemicals)

Equipment needs to provide speech or tactile output.

Environment: (fumes, odors, dust, temperature, noise, group-work)

Working in a group is a good strategy as long as group members help maximize Rocky's participation.

Physical Challenges	**Accommodations Needed**	**Options and Resources**
15. Other: Physical orientation.	• A thorough lab orientation should be conducted including all safety aspects of the lab. Emergency evacuation should also be addressed. • Classroom layout should remain constant. • Room should be uncluttered.	• Special Education teacher for curriculum modifications. • Vision specialist for access and mobility concerns. • Talk with student about room layout and emergency procedures.
Sensory Challenges	**Accommodations Needed**	**Options and Resources**
1. Blind.	• Provide Braille labels on equipment drawers. • Provide tactile models. • Provide good verbal descriptions of visual objects. • Team with a responsible peer or peers. • Give extra time to complete assignments due to slower Braille reading speed. • Provide assistance with some manipulatives. • Provide computer with Braille and speech output.	• Special Education teacher. • Vision specialist. • Work with computer specialist to adapt computer. • Talk with student about best accommodations for specific activities.
Cognitive Challenges	**Accommodations Needed**	**Options and Resources**
10. Self-esteem is low. 10. Self-advocacy skills are poor.	• Provide praise for correctly completed assignments. • Support self-advocacy efforts. • Support on-task behavior. • Pair with a peer. Set boundaries and do not assign less work or work of complexity. • Encourage self-advocacy behaviors.	• Consult with Special Education Teacher. • Talk with student about skills in self-advocacy.

Physical Issues	Sensory Issues	Cognitive Issues
Think of the required physical aspects of the task. What will make the environment accessible, keep the student safe and allow him/her to be an active participant? What lab equipment must be manipulated?	Think of room temperature, noise, fumes, dust, odors, allergies. Also consider the ability to speak and/or communicate, and the visual aspects of the task or assignment.	Is the assignment done with a group, partner or individually? What memory & communication skills are needed? What is the level of complexity of the task.
Physical Challenges	**Sensory Challenges**	**Cognitive Challenges**
1. lift / carry 2. stamina / endurance 3. push / pull 4. knee / squat 5. reach 6. repetitive tasks 7. fine motor: pinch / grasp 8. fine motor: manipulate / maneuver 9. gross motor 10. sit in chair 11. walk / stand 12. balance 13. bend / twist 14. stoop / crouch 15. other	1. vision 2. hearing 3. touch 4. smell 5. taste 6. oral communication 7. temperature 8. fumes 9. external stimuli 10. lighting 11. other	1. short term memory 2. long term memory 3. task complexity 4. reading 5. writing 6. spelling 7. string of numbers (math) 8. paying attention 9. visual, auditory, or kinesthetic learner. 10. self-esteem / advocacy issues 11. behavior issues / acting out 12. other

Alice B.

STUDENT ABILITIES PROFILE

DO-IT

Narrative:

Alice is a people person. She is a 16 year old sophomore who comes to class on time but is rarely prepared to participate in classroom activities nor does she have the proper school supplies. She is extremely distractible. She is currently being tested for ADHD and the family is considering some form of drug therapy. Every item in the classroom becomes a tool, toy, or weapon. She has an above average I.Q. but does not follow through on assignments. Noise is a major distraction for Alice. Working in a group and sitting close to a window or door (away from the teacher) worsens the situation. She does not like quiet and creates verbal distractions. Alice has limited vision that is correctable with glasses.

Task / Assignment:

Actively participating in science classroom and lab experiences, including lab manipulations, field trips.

Equipment: (Lab equipment, protective clothing, chemicals)

Environment: (fumes, odors, dust, temperature, noise, group-work)

Physical Challenges None.	**Accommodations Needed** None.	**Options and Resources** Not applicable.
Sensory Challenges 1. Easily distracted by external visual stimuli (windows, exits, people).	**Accommodations Needed** • Dim lights away from task at hand. • Close outside blinds. • Provide seating close to the teacher. • Allow for individual work or with a responsible partner. • Limit external stimulation (only have necessary items within reach during lab experiences)	**Options and Resources** • Consult with specialist in ADHD. • Consult with vision specialist. • Explore purchasing a cubicle or study area that can be used for individual work. • Allow her to take exams in an area where external stimulation is limited. • Meet with parents for possible suggestions to increase class production.
Cognitive Challenges 3. Complex tasks are difficult to complete. 11. Acts out in class. 12. Other: Does not complete tasks and assignments.	**Accommodations Needed** • Support on-task behavior. • Pair with peer. Set boundaries and do not assign less work in complexity or volume. • Seat close to the teacher. • Structure classroom transitions. • Plan for "down time". • Seat with back to window. • Seat next to quieter students. • Explain assignments eye-to-eye. • Praise accomplishments and good behavior.	**Options and Resources** • Meet with parents. • Meet with vision specialist. • Meet with ADHD specialist. • Follow-up on ADHD testing. • Follow-up with family on medical issues. • Talk with students about best strategies for achieving academic success.

Physical, Sensory, & Cognitive Issues and Challenges

Physical Issues	Sensory Issues	Cognitive Issues
Think of the required physical aspects of the task. What will make the environment accessible, keep the student safe and allow him/her to be an active participant? What lab equipment must be manipulated?	Think of room temperature, noise, fumes, dust, odors, allergies. Also consider the ability to speak and/or communicate, and the visual aspects of the task or assignment.	Is the assignment done with a group, partner or individually? What memory & communication skills are needed? What is the level of complexity of the task.
Physical Challenges	**Sensory Challenges**	**Cognitive Challenges**
1. lift / carry 2. stamina / endurance 3. push / pull 4. knee / squat 5. reach 6. repetitive tasks 7. fine motor: pinch / grasp 8. fine motor: manipulate / maneuver 9. gross motor 10. sit in chair 11. walk / stand 12. balance 13. bend / twist 14. stoop / crouch 15. other	1. vision 2. hearing 3. touch 4. smell 5. taste 6. oral communication 7. temperature 8. fumes 9. external stimuli 10. lighting 11. other	1. short term memory 2. long term memory 3. task complexity 4. reading 5. writing 6. spelling 7. string of numbers (math) 8. paying attention 9. visual, auditory, or kinesthetic learner. 10. self-esteem / advocacy issues 11. behavior issues / acting out 12. other

John B.

STUDENT ABILITIES PROFILE

DO-IT

Narrative:

John is a 17 year old junior. He is a bright and intelligent student who loves science. He has aspirations of being a veterinarian. Due to a birth defect he has only one hand, with only a small residual limb below the elbow. He tries to be as independent as possible. He has a prosthesis for grasping objects. He may need a grabbing device to accomplish some tasks. A surgical glove on the good hand may help him hold slippery glass objects. He may have some difficulty with small manipulatives. John works well in groups or with a lab partner, always contributing and doing his part of the group assignment.

Task / Assignment:

Actively participating in science classroom and lab experiences, including lab manipulations and field trips.

Equipment: (Lab equipment, protective clothing, chemicals)

Grabbing device. Equipment that requires only one hand to manipulate.

Environment: (fumes, odors, dust, temperature, noise, group-work)

Effective in a group setting.

Physical Challenges 1. Difficulty lifting and carrying lab objects. 5. Difficulty reaching some objects. 7. Difficulty pinching and grasping and manipulating fingers.	**Accommodations Needed** • Provide a lab partner or group work. • Provide a C-clamp for holding objects. • Provide a surgical glove for handling wet or slippery items. • Provide a beaker and other equipment with handles. • Provide more time for lab set-up, taking notes and completing tasks. • Consider oral or tape-recorded exams. • Provide a scribe for some tasks.	**Options and Resources** • Work with physical therapist to increase independence. • Collaborate with IEP team on goals & objectives as well as transition plans for postsecondary education. • Work with physical education teacher to increase strength and dexterity in both arms.
Sensory Challenges None.	**Accommodations Needed** None.	**Options and Resources** Not applicable.
Cognitive Challenges None.	**Accommodations Needed** None.	**Options and Resources** Not applicable.

Physical Issues	**Sensory Issues**	**Cognitive Issues**
Think of the required physical aspects of the task. What will make the environment accessible, keep the student safe and allow him/her to be an active participant? What lab equipment must be manipulated?	Think of room temperature, noise, fumes, dust, odors, allergies. Also consider the ability to speak and/or communicate, and the visual aspects of the task or assignment.	Is the assignment done with a group, partner or individually? What memory & communication skills are needed? What is the level of complexity of the task.
Physical Challenges	**Sensory Challenges**	**Cognitive Challenges**
1. lift / carry 2. stamina / endurance 3. push / pull 4. knee / squat 5. reach 6. repetitive tasks 7. fine motor: pinch / grasp 8. fine motor: manipulate / maneuver 9. gross motor 10. sit in chair 11. walk / stand 12. balance 13. bend / twist 14. stoop / crouch 15. other	1. vision 2. hearing 3. touch 4. smell 5. taste 6. oral communication 7. temperature 8. fumes 9. external stimuli 10. lighting 11. other	1. short term memory 2. long term memory 3. task complexity 4. reading 5. writing 6. spelling 7. string of numbers (math) 8. paying attention 9. visual, auditory, or kinesthetic learner. 10. self-esteem / advocacy issues 11. behavior issues / acting out 12. other

Merri M.

STUDENT ABILITIES PROFILE

DO-IT

Narrative:

Merri is a 16-year-old junior who has had cerebral palsy since birth. She uses a wheelchair for mobility and has significant fine motor control difficulties. She is quiet in class but very friendly. She has difficulty expressing her thoughts verbally, but can be understood when she speaks slowly. Her family is very supportive of her participation in all school activities. She needs extra room to maneuver her wheelchair. Additionally, she needs a large flat surface for experiments that is lower and that allows 29" of clearance underneath. Her chair should be facing the board so she does not have to turn her head. A mirror above teacher demonstrations would be helpful. Group work or work with a partner is best for Merri. The group should allow her to participate to the highest degree possible. Some instruction by the teacher to the group would be helpful to assure maximum participation.

Task / Assignment:

Actively participating in science and math classroom and lab experiences, including lab manipulations, field trips & classroom discussions.

Equipment: (Lab equipment, protective clothing, chemicals)

Environment: (fumes, odors, dust, temperature, noise, group-work)

Physical Challenges

1. Lifting.
7. Fine motor, pinch, and grasp.
11. Walk / stand.
15. Difficult to turn head.

Sensory Challenges

None.

Accommodations Needed

- Practice lifting small objects / loads.
- Provide modified PE stressing strength and fine motor enhancement.
- Monitor closely in lab & note increased ability in above physical areas. Lab area / desk must be accessible.
- Needs a lab partner.
- Group should take time to allow slower verbalization.
- Hold high expectations for quality of work completed.
- Allow assistance with manipulatives.
- Needs a lap-desk for microscope and a taller or extended eyepiece.
- Sit to allow talking to her at eye-level.
- Instruct in her line of vision. No sudden location changes.
- Needs more time for labs to set up.
- Needs more time for writing on test.
- Provide a scribe for some tasks.
- Provide a note-taker for some labs would help.

Options and Resources

- Special education teacher regarding social skills.
- Doctor regarding stamina, safety issue.
- Physical therapist / PE teacher
- Work with IEP team to create a modified PE class.
- Determine vendors of modified lab equipment and furniture.
- Determine computer software for word processing and voice activation such as Dragon Dictate.
- Determine options to increase self-reliance and independence.

Options and Resources

Not Applicable.

Cognitive Challenges

2. Long term memory.
3. Task complexity.
4. Reading.
5. Writing.
6. Spelling.
9. Self-esteem / advocacy issues.

Accommodations Needed

- Shorter reading time.
- Break down assignments.
- Allow extra time on tests.
- Praise accomplishments.

Options and Resources

Not applicable.

Physical, Sensory, & Cognitive Issues and Challenges

Physical Issues	**Sensory Issues**	**Cognitive Issues**
Think of the required physical aspects of the task. What will make the environment accessible, keep the student safe and allow him/her to be an active participant? What lab equipment must be manipulated?	Think of room temperature, noise, fumes, dust, odors, allergies. Also consider the ability to speak and/or communicate, and the visual aspects of the task or assignment.	Is the assignment done with a group, partner or individually? What memory & communication skills are needed? What is the level of complexity of the task.
Physical Challenges	**Sensory Challenges**	**Cognitive Challenges**
1. lift / carry 2. stamina / endurance 3. push / pull 4. knee / squat 5. reach 6. repetitive tasks 7. fine motor: pinch / grasp 8. fine motor: manipulate / maneuver 9. gross motor 10. sit in chair 11. walk / stand 12. balance 13. bend / twist 14. stoop / crouch 15. other	1. vision 2. hearing 3. touch 4. smell 5. taste 6. oral communication 7. temperature 8. fumes 9. external stimuli 10. lighting 11. other	1. short term memory 2. long term memory 3. task complexity 4. reading 5. writing 6. spelling 7. string of numbers (math) 8. paying attention 9. visual, auditory, or kinesthetic learner. 10. self-esteem / advocacy issues 11. behavior issues / acting out 12. other

Niel D.

STUDENT ABILITIES PROFILE

DO-IT

Narrative:
Niel is an 18-year-old senior who has cerebral palsy. He has good upper body strength, but limited fine motor skills. Manipulating small objects can be difficult. He uses a wheelchair and can also use crutches for shorter distances. Neil is cooperative and very assertive in making his physical needs known and understood to his instructors. He dislikes it when other classmates tease him and strives to make his work perfect. He needs assistance with toileting and with self-esteem and advocacy issues. He tends to fatigue easily and experiences memory difficulties with complex tasks.

Task / Assignment:
Actively participating in science classroom and lab experiences, including on-site field trips.

Equipment: (Lab equipment, protective clothing, chemicals)

Environment: (fumes, odors, dust, temperature, noise, group-work)

Physical Challenges	**Accommodations Needed**	**Options and Resources**
2. Endurance and stamina 5. Reaching equipment 7. Finger manipulation, pinch, and grasp 11. Standing 12. Balance	• Provide a "grabber" device and surgical gloves to increase ability to grasp. • Provide a work station that is low enough and accessible to a wheelchair. • Schedule field trips in morning, reduce length of assignments / tasks, and provide air-conditioned environment to reduce fatigue.	• Special education teacher. • Doctor. • Physical therapist & speech therapist • Get information on lift-equipped vans from a variety of manufacturers. • Get information on accessible lab furniture from local vendor. • Purchase adaptive technology for computer access (e.g. speech recognition, word prediction, head wand.) • Visit ATL at UW library. • Provide AT evaluation.
Sensory Challenges	**Accommodations Needed**	**Options and Resources**
None.	None.	Not applicable.
Cognitive Challenges	**Accommodations Needed**	**Options and Resources**
2. Long term memory.	• Shorten reading time and procedure for labs to avoid fatigue. • Provide tape-recorded texts. • Give praise for correctly completed tasks. • Be patient & allow extra time for testing.	• Special education teacher. • Doctor. • Physical therapist.

Physical Issues	Sensory Issues	Cognitive Issues
Think of the required physical aspects of the task. What will make the environment accessible, keep the student safe and allow him/her to be an active participant? What lab equipment must be manipulated?	Think of room temperature, noise, fumes, dust, odors, allergies. Also consider the ability to speak and/or communicate, and the visual aspects of the task or assignment.	Is the assignment done with a group, partner or individually? What memory & communication skills are needed? What is the level of complexity of the task.
Physical Challenges	**Sensory Challenges**	**Cognitive Challenges**
1. lift / carry 2. stamina / endurance 3. push / pull 4. knee / squat 5. reach 6. repetitive tasks 7. fine motor: pinch / grasp 8. fine motor: manipulate / maneuver 9. gross motor 10. sit in chair 11. walk / stand 12. balance 13. bend / twist 14. stoop / crouch 15. other	1. vision 2. hearing 3. touch 4. smell 5. taste 6. oral communication 7. temperature 8. fumes 9. external stimuli 10. lighting 11. other	1. short term memory 2. long term memory 3. task complexity 4. reading 5. writing 6. spelling 7. string of numbers (math) 8. paying attention 9. visual, auditory, or kinesthetic learner. 10. self-esteem / advocacy issues 11. behavior issues / acting out 12. other

Richard L.

STUDENT ABILITIES PROFILE

DO-IT

Narrative:

Richard is an 18-year-old junior who is profoundly deaf, has low muscle tone, and some neurological problems similar to autism. He is bright and communicates through sign language interpreters, written notes, and lip reading. He loves math, computers and cooking. Richard uses dual hearing aids and can benefit from auditory training. He can get quite animated and disruptive at times. His reading level is two grade levels below his present class status.

Task / Assignment:

Actively participating in science classroom and lab experiences, including lab manipulations, field trips.

Equipment: (Lab equipment, protective clothing, chemicals)

Hold Richard's attention when instructing the class. May need to repeat instructions directly to him. This is especially true for safety procedures.

Environment: (fumes, odors, dust, temperature, noise, group-work)

Group work may be distracting to William. Check progress frequently.

Physical Challenges	Accommodations Needed	Options and Resources
1. Lifting. 3. Push / pull. 12. Balance. 14. Stoop/crouch.	• Practice lifting small objects/loads. • Provide modified PE stressing strength, and fine motor and balance enhancement. • Monitor closely in lab & note increased ability in above physical areas. • Provide assistance with manipulatives. • Repeat lab safety procedures periodically.	• Special Education teacher regarding social skills. • Hearing specialist regarding auditory issues. • Doctor. • Physical therapist / Physical education teacher. • Work with IEP team to create a modified PE class.
Sensory Challenges	**Accommodations Needed**	**Options and Resources**
2. Hearing.	• Provide auditory training. • Speak directly to the student. • Provide written material and describe / explain procedures and written content. • Team with a possible peer. • Repeat lab safety procedures periodically.	• Special Education teacher. • Hearing specialist. • Work closely with IEP team. • Work with sign language interpreters.
Cognitive Challenges	**Accommodations Needed**	**Options and Resources**
3. Task complexity. 4. Reading level. 10. Self-esteem advocacy issues.	• Provide praise for correctly completed assignments. • Support self-advocacy efforts. • Support on-task behavior. • Pair with peer. Set boundaries and do not assign less work in complexity or volume. • Provide materials at appropriate reading level. • Provide special assistance with abstract concepts using manipulatives whenever possible. • Provide computer CD with dictionary, thesaurus & vocabulary building components.	• Special education teacher. • Hearing specialist. • Provide scheduling software to assist with planning and scheduling interpreters. • Use vocabulary building software. • Research appropriate software with input from hearing specialist.

Physical Issues Think of the required physical aspects of the task. What will make the environment accessible, keep the student safe and allow him/her to be an active participant? What lab equipment must be manipulated?	**Sensory Issues** Think of room temperature, noise, fumes, dust, odors, allergies. Also consider the ability to sp and/or communicate, and the visual aspects of t task or assignment.
Physical Challenges	**Sensory Challenges**
1. lift / carry 2. stamina / endurance 3. push / pull 4. knee / squat 5. reach 6. repetitive tasks 7. fine motor: pinch / grasp 8. fine motor: manipulate / maneuver 9. gross motor 10. sit in chair 11. walk / stand 12. balance 13. bend / twist 14. stoop / crouch 15. other	1. vision 2. hearing 3. touch 4. smell 5. taste 6. oral communication 7. temperature 8. fumes 9. external stimuli 10. lighting 11. other

ues se, fumes, dust, he ability to speak sual aspects of the	**Cognitive Issues** Is the assignment done with a group, partner or individually? What memory & communication skills are needed? What is the level of complexity of the task.
enges	**Cognitive Challenges**
	1. short term memory 2. long term memory 3. task complexity 4. reading 5. writing 6. spelling 7. string of numbers (math) 8. paying attention 9. visual, auditory, or kinesthetic learner. 10. self-esteem / advocacy issues 11. behavior issues / acting out 12. other

Alan T.

STUDENT ABILITIES PROFILE

Narrative:
Alan is a 16-year-old sophomore who has a mild learning disability. He has extreme short-term memory loss and cannot handle complex assignments. He has difficulty processing mathematic concepts (discalcula). Alan is very popular and is a class leader. He demonstrates responsibility and good judgement. He can get angry when his disability affects his learning. He hates to acknowledge that he has a disability. He does not like to receive special services or be singled out in any way. He will need some special assistance to pass the class.

Task / Assignment:
Actively participating in science classroom and lab experiences, including lab manipulations, field trips.

Equipment: (Lab equipment, protective clothing, chemicals)
Alan needs no special equipment modifications.

Environment: (fumes, odors, dust, temperature, noise, group-work)
Choose groups carefully. A supportive peer group is essential, however, it should not be a group that does the work for him. This type of group will prevent some outbursts and hostility. Check progress frequently.

Physical Challenges	**Accommodations Needed**	**Options and Resources**
None.	None.	Not applicable.
Sensory Challenges	**Accommodations Needed**	**Options and Resources**
None	None.	Not applicable.
Cognitive Challenges	**Accommodations Needed**	**Options and Resources**
1. Short term memory. 2. Long term memory. 3. Task complexity. 4. Reading. 5. Writing. 6. Spelling.	• Have him take notes on each lesson. • Write down all assignments. • Encourage use of a *Daytimer* or *Franklin Planner*. • Verbalize carefully & repeat instructions. • Provide peer tutoring. • Use multi-modal teaching techniques. • YELLOW highlight important vocabulary. • Test individually and possibly orally. • Use alternate grade reporting.	Not applicable.

Physical Issues	**Sensory Issues**	**Cognitive Issues**
Think of the required physical aspects of the task. What will make the environment accessible, keep the student safe and allow him/her to be an active participant? What lab equipment must be manipulated?	Think of room temperature, noise, fumes, dust, odors, allergies. Also consider the ability to speak and/or communicate, and the visual aspects of the task or assignment.	Is the assignment done with a group, partner or individually? What memory & communication skills are needed? What is the level of complexity of the task.
Physical Challenges	**Sensory Challenges**	**Cognitive Challenges**
1. lift / carry 2. stamina / endurance 3. push / pull 4. knee / squat 5. reach 6. repetitive tasks 7. fine motor: pinch / grasp 8. fine motor: manipulate / maneuver 9. gross motor 10. sit in chair 11. walk / stand 12. balance 13. bend / twist 14. stoop / crouch 15. other	1. vision 2. hearing 3. touch 4. smell 5. taste 6. oral communication 7. temperature 8. fumes 9. external stimuli 10. lighting 11. other	1. short term memory 2. long term memory 3. task complexity 4. reading 5. writing 6. spelling 7. string of numbers (math) 8. paying attention 9. visual, auditory, or kinesthetic learner. 10. self-esteem / advocacy issues 11. behavior issues / acting out 12. other

Penny L.

STUDENT ABILITIES PROFILE

DO-IT

Narrative:

Penny is an 18-year-old senior who is extremely gifted mentally. She quickly grasps concepts and has a whimsical and creative intellect. Penny is highly unorganized and does not keep track of or turn in assignments. She rarely does any written work on her own without much encouragement. She is non-cooperative and her parents have given up. She participates fully in physical activities but never hands in lab reports or homework.

Task / Assignment:

Actively participating in science and math classroom and lab experiences, including lab manipulations, field trips & classroom discussions.

Equipment: (Lab equipment, protective clothing, chemicals)

Hold Penny's attention when instructing the class. May need to repeat instructions directly to him. This is especially true of safety procedures.

Environment: (fumes, odors, dust, temperature, noise, group-work)

Group work may be distracting to Penny. Check progress frequently.

Physical Challenges	**Accommodations Needed**	**Options and Resources**
None.	None.	Not applicable.
Sensory Challenges	**Accommodations Needed**	**Options and Resources**
None	None.	Not applicable.
Cognitive Challenges	**Accommodations Needed**	**Options and Resources**
8. Attention span.	• Needs one-on-one to force the issue of completing assignments. • Needs an assignment book with teacher signatures on a daily or bi-weekly basis. • Needs lots of follow-up on assignments. • Needs good communication with and between teachers. • Could benefit from a *Daytimer™* or *Franklin Planner™*.	Not applicable.

Physical, Sensory, & Cognitive Issues and Challenges

Physical Issues	Sensory Issues	Cognitive Issues
Think of the required physical aspects of the task. What will make the environment accessible, keep the student safe and allow him/her to be an active participant? What lab equipment must be manipulated?	Think of room temperature, noise, fumes, dust, odors, allergies. Also consider the ability to speak and/or communicate, and the visual aspects of the task or assignment.	Is the assignment done with a group, partner or individually? What memory & communication skills are needed? What is the level of complexity of the task.
Physical Challenges	**Sensory Challenges**	**Cognitive Challenges**
1. lift / carry	1. vision	1. short term memory
2. stamina / endurance	2. hearing	2. long term memory
3. push / pull	3. touch	3. task complexity
4. knee / squat	4. smell	4. reading
5. reach	5. taste	5. writing
6. repetitive tasks	6. oral communication	6. spelling
7. fine motor: pinch / grasp	7. temperature	7. string of numbers (math)
8. fine motor: manipulate / maneuver	8. fumes	8. paying attention
9. gross motor	9. external stimuli	9. visual, auditory, or kinesthetic learner.
10. sit in chair	10. lighting	10. self-esteem / advocacy issues
11. walk / stand	11. other	11. behavior issues / acting out
12. balance		12. other
13. bend / twist		
14. stoop / crouch		
15. other		

Abby R.

STUDENT ABILITIES PROFILE

DO-IT

Narrative:

Abby is a 16-year-old sophomore. She sustained a head injury in a boating accident in 8th grade, which reduced her I.Q. She had to relearn basic skills (alphabet, counting, etc). Her social life completely changed when she had to leave honors programs and join "regular ed." Her family is supportive but conflict between the 4 siblings occurred when Abby appeared to receive more attention than the others. Abby's memory is full of "blank" spots.

Task / Assignment:

Equipment: (Lab equipment, protective clothing, chemicals)

Check Abby with safety procedures as she may have forgotten some safety basics and may have difficulty following directions. Make positive specific statements (Put on safety goggles.) She may not recognize the names of some equipment being used.

Environment: (fumes, odors, dust, temperature, noise, group-work)
Environment may be distracting when students work in groups. Assign someone to work closely with Abby and check her progress frequently.

Physical Challenges 15. Facial tics and slight facial paralysis. Jerky & some uncontrolled body movement.	**Accommodations Needed** • Needs extra time to respond verbally. • Better one-on-one than in larger groups. • Have partner assist with some manipulatives.	**Options and Resources** Not applicable.
Sensory Challenges None.	**Accommodations Needed** None.	**Options and Resources** Not applicable.
Cognitive Challenges 2. Long term memory is lacking. 11. Personality change from extrovert to introvert. 12. Experiences loss of focus.	**Accommodations Needed** • Always check for present knowledge level. • Never assume content knowledge. • Probe for information on feelings and thoughts. • Don't assume consistent reactions. • Have her repeat instructions back to the instructor and / or partners to help keep her on task.	**Options and Resources** Not applicable.

Physical Issues	Sensory Issues	Cognitive Issues
Think of the required physical aspects of the task. What will make the environment accessible, keep the student safe and allow him/her to be an active participant? What lab equipment must be manipulated?	Think of room temperature, noise, fumes, dust, odors, allergies. Also consider the ability to speak and/or communicate, and the visual aspects of the task or assignment.	Is the assignment done with a group, partner or individually? What memory & communication skills are needed? What is the level of complexity of the task.
Physical Challenges	**Sensory Challenges**	**Cognitive Challenges**
1. lift / carry 2. stamina / endurance 3. push / pull 4. knee / squat 5. reach 6. repetitive tasks 7. fine motor: pinch / grasp 8. fine motor: manipulate / maneuver 9. gross motor 10. sit in chair 11. walk / stand 12. balance 13. bend / twist 14. stoop / crouch 15. other	1. vision 2. hearing 3. touch 4. smell 5. taste 6. oral communication 7. temperature 8. fumes 9. external stimuli 10. lighting 11. other	1. short term memory 2. long term memory 3. task complexity 4. reading 5. writing 6. spelling 7. string of numbers (math) 8. paying attention 9. visual, auditory, or kinesthetic learner. 10. self-esteem / advocacy issues 11. behavior issues / acting out 12. other

Tyler D.

STUDENT ABILITIES PROFILE

DO-IT

Narrative:

Tyler is a 17-year-old senior enrolled in special education. He is diagnosed as having ADHD and has written communication difficulties. He is friendly and works well with others. He is in constant motion and cannot sit still.

Task / Assignment:

Equipment: (Lab equipment, protective clothing, chemicals)

Needs highlighted textbooks and cardboard cutout to highlight one line of text at a time and to keep him tracking on a task.

Environment: (fumes, odors, dust, temperature, noise, group-work)

Choose groups carefully. A supportive peer group is essential, however, it should not be a group that does the work for him. Check progress frequently.

Physical Challenges	**Accommodations Needed**	**Options and Resources**
None.	None.	Not applicable.
Sensory Challenges	**Accommodations Needed**	**Options and Resources**
None	None.	Not applicable.
Cognitive Challenges	**Accommodations Needed**	**Options and Resources**
5. Has difficulty expressing himself in written form. 8. Attention span - very active and moves all the time.	• Deliver tests orally; have Tyler dictate test answers. • Allow computer journal entries. • Graph paper helps with writing. • Provide extra time for class tasks and assignments. • Reduce amount of written work but check frequently for verbal understanding. • Provide peer tutoring. • Use alternate grade reporting.	Not applicable.

Physical Issues	**Sensory Issues**	**Cognitive Issues**
Think of the required physical aspects of the task. What will make the environment accessible, keep the student safe and allow him/her to be an active participant? What lab equipment must be manipulated?	Think of room temperature, noise, fumes, dust, odors, allergies. Also consider the ability to speak and/or communicate, and the visual aspects of the task or assignment.	Is the assignment done with a group, partner or individually? What memory & communication skills are needed? What is the level of complexity of the task.
Physical Challenges	**Sensory Challenges**	**Cognitive Challenges**
1. lift / carry 2. stamina / endurance 3. push / pull 4. knee / squat 5. reach 6. repetitive tasks 7. fine motor: pinch / grasp 8. fine motor: manipulate / maneuver 9. gross motor 10. sit in chair 11. walk / stand 12. balance 13. bend / twist 14. stoop / crouch 15. other	1. vision 2. hearing 3. touch 4. smell 5. taste 6. oral communication 7. temperature 8. fumes 9. external stimuli 10. lighting 11. other	1. short term memory 2. long term memory 3. task complexity 4. reading 5. writing 6. spelling 7. string of numbers (math) 8. paying attention 9. visual, auditory, or kinesthetic learner. 10. self-esteem / advocacy issues 11. behavior issues / acting out 12. other

One Science Teacher's Experience with the Four-Step Model and the Student Abilities Profile

Kathi Medcalf-Flaker is Department Chair and a Chemistry and Material Science teacher at Mount Rainier High School in Washington State. Her classes include students with a wide variety of skills and abilities. Students with all types of cognitive, sensory, and physical disabilities are being included in her science classroom in increasing numbers and without prior notice. This trend in her school, as well as in many others, can be very intimidating and can lead to a higher level of frustration for both the teacher and the student.

Kathi feels that it is important for teachers to come to grips with the fact that they must be able to teach to all students, regardless of each student's level of physical, sensory, or cognitive ability. Too often science teachers say, "This student shouldn't be in here; the lab is unsafe; they cannot succeed; or I don't know what to do for them." Science teachers can play a key role in halting this practice of not effectively including or leaving out all together students with disabilities in classes. Teachers must provide equal opportunities for all students, even if it means modifying the way they have conducted business in the past. They need to let go of some of their fears and misconceptions about students with disabilities in science classes.

A major concern to all teachers is time. Where do they find time to do all of the things they are supposed to get accomplished in a day and still make individual modifications. In science labs, teachers often feel like they are setting up and taking down labs, managing student behavior, delivering a lesson, assessing a student's progress, all at the same time. Now, on top of that, they are expected to know how to identify and implement special adaptations for students with disabilities. It's natural to sometimes feel that it is just too much to expect from teachers and that they can't be spread that thin.

Kathi was a member of the DO-IT MATH-SCI (Making Accommodations That Help Schools Create Inclusion) project team and, together with several other math, science and special education teachers, she helped develop the *Four-Point Accommodation Model* and a *Student Abilities Profile* to help teachers address the unique needs of students with disabilities in classroom and laboratory settings. Below are comments from Ms. Medcalf-Flaker about her personal experiences using the *Four-Step Accommodation Model* and the *Student Abilities Profile*.

Four-Step Accommodation Model

The Four-Step Accommodation Model helps me break down a classroom or laboratory activity and process what needs to be done to modify the activity to accommodate the student with a disability. Through this process I analyze a task so that I will not be setting myself and the student up to fail.

Step 1 of the model is "What does the task or assignment require?"

In this initial step I take the lab or classroom assignment or task and break it down into simple steps. I must think through the task from a sensory, cognitive, and physical perspective. By being cognizant of the process I am able to determine how the student with a disability can participate to the highest degree possible.

Step 2 of the model is "What physical, sensory, and cognitive skills are needed?"

I identify the specific skills needed to successfully complete the steps of the task from a physical, sensory, and cognitive perspective. I try not to make assumptions like, "There is no way a blind person can do this experiment." Students with disabilities often have unique ways of handling a situation that I may never have thought of.

Step 3 of the model is "What components of the task require accommodation?"

Now, I take the tasks and compare them to the student's abilities and see if accommodations need to be made. I determine the level of difficulty of the task and how best to include the student with a disability to his/her maximum potential. I share the analysis of the task or assignment with the student. I see if he or she has suggestions for accommodations. I always try to be an active listener, as I can learn a lot from the student. It is tough to be on the listening end of the conversation, but it is critical to my teaching success. I remind myself that the student is the only true expert concerning his/her own disability.

Step 4 of the model is "What accommodation options exist?"

Finally, I identify resources that exist for providing the needed accommodations. I ask other staff members or professionals in the district for their opinions. I look for the most readily available resources in making accommodations. In this ballpark, "expensive" does not necessarily equate with "good" or "effective." For instance, a student who is blind could enter data observations from an experiment into a computer while his/her partner describes the lab. Or, a lab experiment could be broken down into components of two steps at a time for a student with Attention Deficit Disorder or a specific learning disability. Sometimes this approach is effective in helping all students better understand the experiment. Several options may exist for an accommodation. For example, a student who is blind may need instructions in Braille or I may need to record them on a cassette tape recorder.

So, what do you do when a student with a disability actually walks or rolls through the doorway? Let's take a look at the *Student Abilities Profile*. Here is how Kathi uses it.

I take a few minutes at the beginning of the year and sit down with a student with a disability and/or the student's special education teacher. This meeting is well worth the time and effort. Consult with the expert, the student, when filling out the profile. Now I have a documented record that helps me focus on what the student can do first and, secondly, with what he or she may need assistance.

Some of the accommodations that I and the student jointly recommend or discuss may be as simple as copying lecture notes, creating a lap-desk for a student who uses a wheelchair to allow her to use a microscope, providing access to safety equipment, or having handouts enlarged for a student with a visual impairment. Using this method, I am better able to understand where the student is coming from and what specific accommodations will work best for her.

I completed the *Student Abilities Profile* on page 69. I keep this document in the student's file. I refer to it during the year when setting up labs and other activities in order to make sure that the student participates to the fullest extent possible. Below is an example of how I used the *Student Abilities Profile* with a student named Alice B, who has Attention Deficit Hyperactivity Disorder (ADHD).

Task/Assignment: Alloying Zinc and Copper

Step 1: The task requires:

1. following directions
2. following safety procedures
3. weighing
4. using a hot plate
5. using a Bunsen burner
6. writing observations

Step 2: The physical, sensory, and cognitive skills required include the following challenges:

Physical Challenges:
1. fine motor grasp/manipulation
2. sitting
3. walking/standing

Sensory Challenges:
1. vision
2. touch
3. smell

Cognitive Challenges:
1. complex thinking
2. reading
3. writing
4. attention span
5. behavior that ensures safety

Step 3: Components of the task that require accommodation:

- Alice B needs no physical accommodations.
- There will need to be some accommodations for sensory issues such as dimming lights, limiting external stimulation, sitting next to quieter students.
- Assignments must be made individually, eye-to-eye.

Step 4: Accommodation options that exist:

- I will make sure that Alice is near me when I explain the directions.
- If the lab is set up in advance, I will not put the items in front of Alice because she will play with the equipment rather than pay attention.
- I will make sure she has a responsible partner for the lab and give her the directions 2-3 steps at a time. When she finishes the steps she can have the next set. This way I know she is following the directions and not jumping around just to get done. It also means that she is checking in with me even if I can't check on her every 10 minutes.
- When the students begin to work, I will check with Alice first and make sure she has heard all of the safety issues before starting.

- Every time Alice does a good job in the lab I will make sure to tell her.

Teachers no longer have a choice. Ethically and legally we are required to meet the academic needs of all of our students. With appropriate accommodations, students with disabilities can be challenged to reach the same high academic standards that we require of students without disabilities. Academic performance standards should not be watered down. All students can learn if given appropriate experiences. The *Student Abilities Profile* and the *Four-Step Accommodation Model* are tools that can help us become better and more effective teachers. They can help us learn to work "with" the student, not just "for" them as we create an optimum learning environment.

A READING LIST

Following is a list of articles and videotapes that can be used for further research and instruction in the area of mathematics and science for students with disabilities.

Anderson-Inman, L., Ditson, L.A., & Diston, M.T. (1997). Computer-based concept mapping: Promoting meaningful learning in science for students with disabilities. Journal of Information Technology and Disabilities, 4(5).

Atwood, R.K., & Oldham, B.R. (1985). Teachers' perceptions of mainstreaming in an inquiry oriented elementary science program. Science Education, 69, 619-624.

Banks, D. (1997). K-12 Web resources for science, engineering and math. Journal of Information Technology and Disabilities, 4(4).

Barrier free in brief: Laboratories and classrooms in science and engineering. (1991). Washington, DC: American Association for the Advancement of Science.

Barry, W.A., Gardner, J.A., & Lundquist, R (1994). Books for blind scientists: The technological requirements of accessibility. Information Technology and Disabilities, 1(4).

Bay, M., Staver, J.R., Bryan, T., & Hale, J.B. (1990). Science instruction for the mildly handicapped: Direct instruction versus discovery teaching. Journal of Research in Science Teaching, 29(6), 555-570.

Black, A.A., Gourgey, K.L. & Kress, M.E. (1994). A graphical calculus course for blind students. Journal of Information Technology and Disabilities, 1(4).

Borron., R. (1978). Modifying science instruction to meet the needs of the hearing impaired. Journal of Research in Science Teaching, 15, 257-262.

Burgstahler, S.E. (1996). Teaching lab courses to students with disabilities. Journal of Information Technology and Disabilities, 3(2), 1996.

Burgstahler, S.E. (1994). Increasing the representation of people with disabilities in science, engineering, and mathematics. Journal of Information Technology and Disabilities, 1(4).

Burgstahler, S.E., & Nourse, S. (1998). Accommodating students with disabilities in math and science classes— Teacher preparation materials. Seattle, WA: DO-IT, University of Washington.

Cawley, J.F. (1994) Science for students with Disabilities. Remedial and Special Education, 15(2), 67-71.

Cetera, M.M. (1993). Laboratory adaptations for visually impaired students. Journal of College Science Teaching, 12(6).

Changing America: The new face of science and engineering. (1989). Washington, DC: National Science Foundation Task Force on Women, Minorities, and the Handicapped in Science and Technology.

Davis, L.E. (1990). Recognizing and accommodating the learning-disabled geology student. Journal of Geological Education, 38(2), 101-04.

Dunn, C., & Rabren, K. (1996). Functional mathematics instruction to prepare students for adulthood. LD Forum, 21(3), 34-40.

Egelston-Dodd, J., & Himmelstein, J. (1996). A constructivist paradigm in science education for students who are deaf and hard-of-gearing. Journal of Science for Persons with Disabilities, 4(1). 20-27.

EASI street to science, engineering and mathematics: An EASI guide to awareness of lab access. (1996). Washington, DC: American Association for Higher Education.

EASI street to science, technology & math: Issues for K-12 students with disabilities. Washington, DC: American Association for Higher Education.

Frinks, R. M. (1985). Accommodating mobility-impaired students in physics laboratories. Physics Teacher, 21.

Grossen, B., & Burke, M.D. (1997). Instructional design that accommodates special learning needs in science. Journal of Information Technology and Disabilities, 4(5).

Gurganus, S., et al. (1995). Science instruction: What special education teachers need to know and what roles they need to play. Teaching Exceptional Children, 27(4), 7-9.

Gurganus, S., & Janas, M. (1995). Your kids and our kids: Cooperative science instruction for students with mild to moderate disabilities. Journal of Science for Persons with Disabilities, 3(1), 11-17.

Hayden, Melissa; , et al. (1992). Using computer networking to increase active teaching in general education math classes containing students with mild disabilities. Journal of Special Education Technology, 11(4), 167-77.

High School/High Tech: establishing a program to promote science, engineering, and technology careers for students with disabilities (videotape). Washington, DC: Presidents' Committee on Employment of People with Disabilities.

Janas, M. (1996). Facilitating science mentorships for students with disabilities. Journal of Science for Persons with Disabilities, 4(1), 6-10.

Jarchow, E.M., & Karli, W. (1983). Hearing impairment (does not equal) career impairment. The Science Teacher, 50 (9), 23-25.

Jitendra, A, & Xin, Y. (1997). Mathematical word-problem-solving instruction for students with mild disabilities and students at risk for math failure: A research synthesis. Journal of Special Education, 30(4), 412-38.

Kimmel, H. & Deek, F.P. (1995). Instructional technology: A tool or a panacea? Journal of Science Education and Technology, 4 (4), 327-332.

Koeber, N. (1994). What special problems do children with disabilities face in science? What can teachers and schools do? In What We Know About Science Teaching and Learning. EdTalk. Washington, DC: Council for Education Development and Research.

Kucera, F. (Ed.). (1993). Teaching chemistry to students with disabilities. Washington, DC: American Chemical Society.

Kumar, D., & Wilson, C.L. (1997). Computer technology, science education, and students with learning disabilities. Journal of Science Education and Technology, 6(2), 155-60.

Lang, H.G. (1983). Preparing science teachers to deal with handicapped students. Science Education, 67(4), 541-542.

Lang, H.G. (1973). Teaching physics to the deaf. The Physics Teacher, 11, 527-531.

Lang, H.G., & Caccamise, F. (1980). One-on-one with the hearing-impaired. The Science Teacher, 47 (8), 20-25.

Lehman, J.R. (1994). Technology use in the teaching of mathematics and science in elementary schools. School Science and Mathematics, 94(4), 194-202.

Lunney, D. (1995). Assistive technology in the science laboratory: A talking laboratory work station for visually impaired science students. Journal of Information Technology and Disabilities, 2(1).

Malcom, S.M., & Matyas, M.L. (Eds.) (1991). Investing in human potential: Science and engineering at the crossroads. Washington, DC: American Association for the Advancement of Science.

Mastropieri, M.A., & Scruggs, T.E. (1995). Teaching science to students with disabilities in general education settings: Practical and proven strategies. Teaching Exceptional Children, 27(4), 10-13.

Mastropieri, M.A., & Scruggs, T. E. (1992). Science for students with disabilities. Review of Educational Research, 62(4), 377-411.

McDaniel, N., Mahaffy, C., Teggins, J., & Wolfe, G. (1994). Inclusion of students with disabilities in a college chemistry laboratory course. Journal of Postsecondary Education and Disabilities, 11(1), 20-28. Columbus, Ohio: Association on Higher Education and Disability.

McFarland, J.L. (1997). A comparison of regular students and students with learning disabilities on a performance-based assessment in the area of science. Learning Disabilities. A Multidisciplinary Journal, 8 (2), 109-15.

McGinnis, J.R., & Nolet, V. W. (1995). Diversity, the science classroom, and inclusion: A collaborative model between the science teacher and the special educator. Journal of Science for Persons with Disabilities, 3 (1), 31-35.

Miller, D.E. (1992). Math across America: Motivating learners with mild disabilities. Teaching Exceptional Children, 24 (2), 47-49.

Schleppenbach, D. (1996). Teaching science to the visually impaired: Purdue University's Visions Lab. Journal of Information Technology and Disabilities, 3(4).

Scruggs, T.E., & Mastropieri, M.A. (1995). What makes special education special? Journal of Special Education, 29, 224-233.

Scruggs, T.E., & Mastropieri, M.A. (1993). Current approaches to science education: Implications for mainstream instruction of students with disabilities. Remedial and Special Education, 14(1), 15-24.

Sevilla, J., et al. . (1991) Physics for blind students: A lecture on equilibrium. Physics Education, 26(4), 227-30.

Seymour, E., & Hunter, A. (1998). Talking about disability: The education and work experience of graduates and undergraduates with disabilities in science, mathematics and engineering majors. Washington, DC: American Association for the Advancement of Science.

Skawinski, W.J., Busanic, T.J., Ofsievich, A.D., Luzhkov, V.B., Venanzi. C.A., & Venanzi, T.J. (1994). The use of laser stereolithography to produce three-dimensional tactile molecular models for blind and visually impaired scientists an students. Journal of Information Technology and Disabilities, 1(4).

Stefanich, G. (1994). Science educators as active collaborators in meeting the educational needs of student with disabilities. Journal of Science Teacher Education, 5(2), 56-65.

Stefanich, G.P., & Egelston-Dodd, J. (Eds.). (1994). Improving science instruction for students with disabilities: Proceedings of a working conference on science for persons with disabilities.

Stefanich, G.P., Egelston-Dodd, J. (Eds.) (1993). A Futures Agenda: Proceedings of a working conference on science for persons with disabilities.

Stefanich, G.P., & Norman, K.I. (1996). Teaching science to students with disabilities: Experiences and perceptions of classroom teachers and science educators. Association for the Education of Teachers in Science.

Stern, V.W., & DuBois, P. (1994). Find your future. Washington, DC: American Association for the Advancement of Science.

Stern, V.W., & DuBois, P. (1994). You're in charge. Washington, DC: American Association for the Advancement of Science.

Stern, V.W., & Summers, L. (1987). Resource directory of scientists and engineers with disabilities. Washington, DC: American Association for the Advancement of Science.

Successful science: Technology and support for students with disabilities (videotape). (1998). Newton, MA: EDC National Center to Improve Practice.

Weisgerber, R.A. (Ed.). (1993). Science success for students with disabilities. Addison-Wesley Publishing Co.

Weisgerber, R.A. (1991). The challenged scientist: Disabilities and the triumph of excellence. New York: Praeger.

What others are doing: Proceedings of a working conference on science for persons with disabilities. (1997). Cedar Falls, IO: University of Northern Iowa.

Wheater, C. P. (1988). Access to science in further and higher education for students with mobility or sensory impairment. Vocational Aspect of Education, 40(107), 117-22.

Wiburg, K. (1995). Learning from mistakes: Research in special education and technology. Learning and Leading with Technology, 64-67.

The winning equation: Access + attitude = success in math and science. Seattle, WA: DO-IT, University of Washington.

MATH AND SCIENCE RESOURCES

There are many resources to assist you in making math and science classes accessible to students with disabilities. Here are a few places to start. Refer to the *Resources* section of this notebook for additional sources of information.

American Association for the Advancement of Science (AAAS)
Project on Science, Technology, and Disability
1200 NY Ave NW
Washington, DC 20005
202-326-6400 (voice/TTY)
202-371-9849 (FAX)
http://www.aaas.org/
A project to improve the entry and advancement of people with disabilities in science, mathematics, and engineering.

American Chemical Society (ACS)
1155 16th Street NW
Washington, D.C. 20036
202-872-4600
202-872-4529 (FAX)
http://www.acs.org/
The world's largest scientific organization. whose committee on Persons with Disabilities publishes a free manual titled Teaching Chemistry to Students with Disabilities.

American Printing House for the Blind, Inc.
1839 Frankfort Avenue
P.O. Box 6085
Louisville, KY 40206-0085
800-223-1839
502-899-2274 (FAX)
info@aph.org
http://www.aph.org/
Products available include math textbooks, tactile graphics kit, graphic aid for mathematics, number line device, abaci, rulers, graph sheets, Braille protractor.

American Thermoform Corporation
2311 Travers Avenue
City of Commerce, CA 90040
800-331-3676
213-728-8877 (FAX)
atc@atcbrleqp.com
http://www.atcbrleqp.com/
Swell-Form Graphics Machine, Swell-Touch Paper, and thermoform machines.

Ann Morris Enterprises, Inc.
890 Fams Court
East Meadow, NY 11554-5101
800-454-3175
516-292-9252
516-292-2522 (FAX)
annmor@netcom.com
http://www.annmorris.com/
Products include talking money identifier, calculators, scientific calculator, thermometer, Braille scale.

The Annenberg/CPB Math and Science Project
http://www.learner.org/sami/
Math and science resources.

Applied Science and Engineering Laboratories
PO Box 269
Wilmington, DE 19899
302-651-6830
302-651-6834 (TTY)
302-651-6895 (FAX)
http://www.asel.udel.edu/
A program devoted to development and dissemination of new technologies for people with disabilities.

Barrier Free Education, Developing Accessible Science Experiments
http://barrier-free.arch.gatech.edu/Lab/index.html
Access to Science Project at Georgia Tech.

Blazie Engineering
105 E. Jarrettsville Rd.
Forest Hill, MD 21050
410-893-9333
410-836-5040 (FAX)
support@blazie.com
http://www.blazie.com/
Graph-it (allows you to use a Braille printer, in conjunction with a PC, Braille 'N Speak, Type 'N Speak, or Braille Lite, as a graphing calculator), refreshable Braille, scientific calculator.

Computers to Help People
825 East Johnson Street
Madison, WI 53703
608-257-5917
chpi@ixecpc.com
The Technical Braille Center was established by a non-profit corporation for blind engineers, scientists and mathematicians. They produce highly technical material in Nemeth Code Braille, with tactile graphics included where practical.

DO-IT (Disabilities, Opportunities, Internetworking, and Technology)
Box 354842
University of Washington
Seattle, WA 98195-4842
206-221-4171 (FAX)
206-685-DOIT (voice/TTY)
888-972-DOIT Washington, outside of Seattle
509-328-9331 (voice/TTY) Spokane office
doit@u.washington.edu
http://www.washington.edu/doit/
DO-IT maintains a useful collection of materials and links to resources on adaptive technology and accessible Web design.

EASI (Equal Access to Software and Information)
http://www.rit.edu/~easi/easisem.html
EASI has received funding to disseminate information on access issues for people with disabilities.

EASI's Science, Engineering and Math Online Workshop
http://www.rit.edu/~easi/workshops.html
Information on teaching strategies and hardware and software solutions that can help people with disabilities gain access to science, engineering and mathematics.

Independent Living Aids, Inc.
27 East Mall
Plainview, NY 11803
800-537-2118
516-752-3135 (FAX)
indlivaids@aol.com
http://www.independentliving.com/
Products include talking money identifier, raised line drawing kit, folding wood ruler, check writing guide, and large display and talking calculators.

Lawrence Hall of Science
Center for Mulitsensory Learning
Berkeley, CA 94720
Creates materials to make science accessible to students with disabilities.

The Lighthouse Inc.
111 E.59th Street
New York, NY 10022
800-829-0500
info@lighthouse.org
http://www.lighthouse.org/
Products include large display and talking calculators, rulers, tape measures, check writing guide, talking money identifier, and telescopic click rules.

Math: Computerized, Spoken and Braille
http://www.rit.edu/~easi/math.html
Links to resources which help individuals with disabilities accessing mathematical and scientific content.

Mathematics Accessible to Visually Impaired Students (MAVIS)
New Mexico State University
Math Department MSC 3MB
P.O. Box 30001
Las Cruces, NM 88003
505-646-2664
505-646-1064 (FAX)
chrweave@nmsu.edu
http://www.nmsu.edu/~mavis
Nemeth Code filter that translates Scientific Notebook documents containing mathematics to Nemeth Code.

Maxi Aids & Appliances for Independent Living
42 Executive Blvd.
P.O. Box 3209
Farmingdale, NY 11735
800-522-6294
516-752-0689
sales@maxiaids.com
http://www.maxiaids.com/
A large selection of products, including large print and talking calculators (including scientific), raised line drawing kits, abaci, rulers, tape measures, and protractor.

National Science Foundation Programs for Persons with Disabilities
4201 Wilson Blvd.
Arlington, VA 22230
202-357-9859
202-357-7492 (TTY)
http://www.nsf.com/
Grants to increase the representation of people with disabilities in science, engineering, mathematics, and technology fields of study and careers.

Project SMART (Science and Math Access: Resources & Technology)
New Jersey Institute of Technology
University Heights
Newark, New Jersey 07102
973-596-3574
973-642-1847 (FAX)
Project to encourage students with disabilities to enter science, engineering, and mathematics fields.

Regional Alliance for Science, Engineering, and Mathematics (RASEM)
New Mexico State University
http://heimdal.nmsu.edu/
Project to encourage students with disabilities to enter science, engineering, and mathematics fields.

Science Access Project
Oregon State University
http://dots.physics.orst.edu/
A project to enhance the ability of people with print disabilities to read, write, and manipulate information, with a focus on math equations, information normally presented in tables and graphs, and information presented in diagrams and figures.

Science Association and Persons with Disabilities
Fresno Pacific College
Fresno, CA 92635
202-453-2000
202-453-2001 (FAX)
A group of mainly secondary and college/university science educators who are teachers of courses including students with disabilities. Many members are themselves disabled.

Science Products
Box 888
Southeastern, PA 19399
800-888-7400
Large selection of talking products, including scientific, statistical, and financial calculators, cash register, and money identifier.

Strategies on teaching science to students with disabilities
http://www.as.wvu.edu/~scidis
Information about students with disabilities and learning science.

Teaching Math to Visually Impaired Students
http://www.tsbvi.edu/math/
Information on access to mathematics for students with visual impairments.

RESOURCES

The *Resources* lists in earlier sections of these materials provide useful pointers to specific resources in computing and math and science instruction for teachers who have students with disabilities in their classes. This *Resources* section includes materials and information of a general nature. The two broad areas included are:

General Resources

Glossary

ACT Test Administration
PO Box 4028
Iowa City, IA 52243
319-337-1332
319-337-1524 (TTY)
319-339-2253 (FAX)
http://www.act.org/
ACT (American College Testing) will arrange for individual administration of an assessment for a student with a disability given proper documentation of the disability.

ADA-LAW Listserv
ADA-LAW is a discussion list for those interested in the Americans with Disabilities Act and other disability-related laws in the United States and other countries. To join, send electronic mail to *listserv@listserv.nodak.edu* with no subject and the following message text: "subscribe ADA-LAW Firstname Lastname".

Alexander Graham Bell Association for the Deaf (AGBA)
3417 Volta Place NW
Washington, D.C. 20007-2778
202-337-5220
AGBellinfo@aol.com
http://www.agbell.org/
AGBA emphasizes oral-deaf education.

American Association of the Deaf-Blind (AADB)
814 Thayer Avenue
Suite 300
Silver Spring, MD 20910-4500
301-588-6545 (TTY)
http://www.tr.wosc.osshe.edu/dblink/aadb.htm
AADB is a national consumer advocacy organization for people who have combined hearing and vision impairments.

American Council of the Blind (ACB)
1155 15th Street NW Suite 720
Washington, DC 20005
800-424-8666
202-467-5081
202-467-5085 (FAX)
http://www.acb.org/
ACB is an information referral and advocacy agent whose goals are to improve the well-being of people who are blind or visually impaired.

American Deafness and Rehabilitation Association (ADARA)
P.O. Box 727
Lusby, Maryland 20657
ADARAorgn@aol.com
http://www.adara.org/
ADARA is a network of professionals who serve people who are deaf or hard of hearing.

American Foundation for the Blind (AFB)
11 Penn Plaza - Suite 300
New York, NY 10001
800-232-5463
212-502-7661
212-502-7662 (TTY)
212-502-7777 (FAX)
afbinfo@afb.org
http://www.afb.org/
AFB was established to serve as the national partner of local services for persons who are blind or visually impaired.

American Institute of Architects (AIA)
Library and Archives
1735 New York Avenue NW
Washington, D.C. 20006
800-365-ARCH
202-626-7493
http://www.aigonline.com/
The Institute publishes bibliographies of material on barrier-free design.

American Printing House for the Blind, Inc. (APH)
PO Box 6085
Louisville, KY 40206-0085
800-233-1839
502-895-2405
502-899-2244 (FAX)
cs@aph.org
http://www.aph.org/
APH is a large not-for-profit company that creates educational, workplace, and lifestyle products and services for people with visual impairments.

American Speech - Language - Hearing Association (ASHA), The
10801 Rockville Pike
Rochville, MD 20852
Answer line: 888-321-ASHA
Action Center: 800-498-2071
301-897-5700
301-897-0157 (TTY)
301-571-0457 (FAX)
http://www.asha.org/
Speech, language, hearing resources.

Americans with Disabilities Act Document Center
http://janweb.icdi.wvu.edu/kinder/
Full-text government documents and legal resources can be found at this non-governmental site maintained by volunteers.

Animated American Sign Dictionary
http://www.bconnex.net/~randys/
American Sign Language.

Applied Science and Engineering Labs
PO Box 269
Wilmington, DE 19899
302-651-6830
302-651-6834 (TTY)
302-651-6895 (FAX)
http://www.asel.udel.edu/
A program devoted to development and dissemination of new technologies for people with disabilities.

Architectural and Transportation Barriers Compliance Board (ATBCB)
1331 F Street NW Suite 1000
Washington, DC 20004-1111
202-272-5434
800-USA-ABLE
202-272-5449 (TTY)
800-993-2822 (TTY)
202-272-5447 (FAX)
info@access-board.gov
http://www.access-board.gov/
Enforces requirements for access to ATBCB federally funded buildings and facilities, sets guidelines under the Americans with Disabilities Act, and provides technical assistance and information.

Association for Higher Education and Disability (AHEAD)
PO Box 21192
Columbus, OH 43221-0192
614-488-4972 (voice/TTY)
614-488-1174 (FAX)
ahead@postbox.acs.ohio-state.edu
http://www.ahead.org/
A professional organization of higher education disability service providers; disseminates information about research, accommodations, and legislation.

Better Hearing Institute
Washington, DC
800-EAR-WELL
mail@betterhearing.org
http://www.betterhearing.org/

Blind Children's Center
4120 Marathon SE
Los Angeles, CA 90029
800-222-3566
http://www.blindcntr.org/bcc

Blind Resource Center
New York Institute of Special Education (NYISE)
Office of Development
999 Pelham Pkwy
Bronx, NY 10469
718-231-9314 ext. 315
718-231-9314 (FAX)
lumin@earthlink.net
http://www.nyise.org/blind.htm
Technology and resources for those who are blind and deaf-blind.

Brain Injury Foundation Help Line
800-444-6443
Information on head injuries.

Candlelighters Childhood Cancer Foundation
7910 Woodmart Ave.
Suite 460
Bethesda, MD 20814-3015
800-762-3334
800-366-2223
301-657-8401
301-718-2686 (FAX)
info@candelighters.org
http://www.candlelighters.org/
Resources for those with childhood cancer.

Captioned Media Program
National Association of the Deaf
1447 E. Main Street
Spartanburg, SCJ 29307
800-237-6213 (VOICE)
800-237-6819 (TTY)
800-538-5636 (FAX)
info@cfv.org
http://www.cfv.org/
The Captioned Medea Program is a free loan service funded by the Department of Education.

Children and Adults with Attention Deficit Disorders (CHADD)
8181 Professional Pl Ste. 201
Landover, MD 20785
800-233-4050
301-306-7070
301-306-7090 (FAX)
http://www.chadd.org/
Behavior management suggestions, information, and resources.

College Board SAT Services Program
PO Box 6226
Princeton, NJ 08541-6226
609-771-7137
609-882-4118 (TTY)
http://www.sat.org/
The College Board provides special arrangements to minimize the possible effects of disabilities on test performance.

Communication Aids for Language and Learning
mmilne@cogsci.ed.oc.uk
http://call-centre.cogsci.ed.ac.uk/callhome
Aids for communication.

Deaf Resources Library
http://www.deaflibrary.org/
Resources regarding hearing impairment.

Disabilities
http://www.medweb.emory.edu/medweb/
Meta index to information on disabilities on the Web.

DO-IT (Disabilities, Opportunities, Internetworking, and Technology)
Box 354842
University of Washington
Seattle, WA 98195-4842
206-685-DOIT (voice/TTY)
888-972-DOIT (voice/TTY) Washington, outside Seattle
509-328-9331 (voice/TTY) Spokane office
206-221-4171 (FAX)
doit@u.washington.edu
http://www.washington.edu/doit/
DO-IT produces free and low cost education publications and video that help librarians and educators learn about access issues related to people with disabilities. DO-IT helps people with disabilities use technology to achieve high levels of independence, productivity, and participation in academic programs and careers.

EASI (Equal Access to Software and Information)
PO Box 18928
Rochester, NY 14618
716-244-9065
http://www.rit.edu/~easi/
EASI is focused on access to technology for people with disabilities. EASI maintains a Web site and publishes an electronic journal.

Easter Seals National Office
230 West Monroe Street 1800
Chicago, IL 60606
312-726-1494 (FAX)
http://www.easterseals.org/
Resources for people with disabilities.

Education Equity Concepts Resource Center
114 E 32nd Street
Suite 701
New York, NY 10016
212-725-1803
212-725-0947 (FAX)
http://www.edequity.org/
This center serves to increase public awareness and understanding of the particular challenges faced by females with disabilities.

Epilepsy Foundation of America
4351 Garden City Drive
Landover, MD 20785-2267
301-459-3700
800-332-1000
800-332-4050
301-577-4941 (FAX)
info@efa.org
http://www.efa.org/

ERIC Clearinghouse on Disabilities and Gifted Education
The Council for Exceptional Children (CEC)
1920 Association Drive
Renton, VA 20191-1589
703-264-9449 (voice/TTY)
800-328-0272 (voice/TTY)
703-620-2521 (FAX)
ericec@cec.sped.org
http://ericec.org/
ERIC is a federally funded, nationwide information network that provides access to educational literature. The popular ASKERIC service allows teachers, librarians, and others to call or send electronic mail questions.

Employment Equity Positive Measures Program
http://www.psc-cfp.gc.ca/eepmp-pmpee/internet_home.htm
The Public Service Commission of Canada sponsors the Employment Equity Positive Measures Program which includes an accessibility test program and other information.

Foundation Center Library
http://www.fdncenter.org/
Information about foundations that fund educational technology.

Guide Dog Foundation for the Blind, Inc.
800-548-4337
http://www.guidedog.org/
Information on guide dogs.

The Foundation Fighting Blindness
Executive Plaza One, Suite 800
11350 McCormick Road
Hunt Valley, MD 21031-1014
800-683-5555
410-785-1414
410-785-9687 (TT)
http://www.blindness.org/
Formerly National Retinitis Pigmentosa Foundation, information on Retinitis Pigmentosa and other visual impairments.

HEATH Resource Center
American Council on Education
One Dupont Circle, Suite 800
Washington, D.C. 20036-1193
202-939-9320 (voice/TTY)
202-833-4760 (FAX)
heath@ace.nche.edu
http://www.acenet.edu/About/programs/Access&Equity/HEATH/home.html
HEATH is a clearinghouse on postsecondary education for individuals with disabilities.

Integrated Network of Disability Information and Education (INDIE)
http://www.indie.ca/
A collaborative venture led by national organizations of persons with disabilities in Canada, INDIE provides a searchable information directory of global disability resources.

Internet Resources for Special Educators
http://specialed.miningco.com/education/specialed/
Various links to areas dealing with such topics as special education, teaching resources for both regular and special education teachers.

Job Accommodation Network (JAN)
ADA Information:
800-526-2262 Canada
800-526-7234 United States
800-ADA-WORK
304-293-5407 (FAX)
jan@jan.icdi.wvu.edu
http://janweb.icdi.wvu.edu/
In the United States, JAN is a service of the President's Committee on Employment of People with Disabilities. In Canada, JAN is a service of the Canadian Council on Rehabilitation and Work. It provides information and consultation about adapting classes, labs, and worksites.

LAB Resources - Other Interesting Places to Visit
http://www.execpc.com/~labres/other_pl.html
Accessible products information.

Learning Disabilities Association
http://www.ldanatl.org/
Information on learning disabilities.

Learning Disabilities and Special Education
http://www.lrdc.pitt.edu/Publications/topics/topics.htm
Articles on teaching students with learning disabilities, Topic # 17.

Library Reproduction Service (LRS)
14214 South Figueroa Street
Los Angeles, CA 90061
800-255-5002
310-354-2610
310-354-2601 (FAX)
lrsprint@aol.com
http://www.lrs-largeprint.com/
LRS produces large print reproductions of educational materials.

Mobility International, USA (MIUSA)
PO Box 10767
Eugene, OR 97440
541-343-1284 (voice/TTY)
541-343-6812 (FAX)
info@miusa.org
http://www.miusa.org/
The American office of this London-based organization serves to integrate persons with disabilities into international educational exchange programs and travel.

National Alliance of Blind Students (NABS)
1155 Fifteenth Street Suite 720
Washington, D.C. 20005
800-424-8666
202-467-5081
202-467-5085 (FAX)
An affiliate of the American Council of the Blind, NABS provides a national voice for students with vision impairments.

National Association of the Deaf
814 Thayer Avenue
Silver Spring, MD 20910-4500
301-587-1788
301-587-1789 (TTY)
301-587-1791 (FAX)
http://www.nad.org/
A consumer advocate organization promoting equal access to communication, education, and employment opportunities for people who are deaf or hard of hearing.

National Captioning Institute (NCI)
5203 Leesburg Pike Suite 1500
Falls Church, VA 22041
703-998-2400
800-533-9673
800-321-8337 (TTY)
http://www.ncicap.org/
NCI provides captioned programming and technology for millions of people who can benefit from captioned television.

National Center for Stuttering
200 East 33rd Street
New York, NY 10016
800-221-2483
212-683-1372
http://www.stuttering.com/
Resources for those who stutter.

National Center to Improve Practice in Special Education Through Technology, Media & Materials
Education Development Center, Inc.
55 Chapel Street
Newton, MA 92158-1060
617-969-7100 ext. 2387
617-969-4529 (TTY)
617-969-3440 (FAX)
ncip@edc.org
http://www2.edc.org/NCIP
Library of information about special education and technology.

National Center to Improve the Tools of Educators (NCITE)
805 Lincoln
Eugene, OR 97401
ncite@darkwing.uoregon.edu
http://idea.uoregon.edu/~ncite/
Resources and strategies to improve teaching.

National Clearinghouse for Rehabilitation Training Materials (NCRTM)
Oklahoma State University
5202 Richmond Hill Drive
Stillwater, OK 74078-4080
1-800-223-5219
405-624-7650
405-624-0695 (FAX)
http://www.nchrtm.okstate.edu/
Sources of information on accommodating students with disabilities.

National Council on Disability (NCD)
1331 F Street NW Suite 1050
Washington, D.C. 20004-1107
202-272-2004
202-272-2074 (TTY)
202-272-2022 (FAX)
mquigley@ncd.gov
http://www.ncd.gov/
An independent federal agency to address, analyze, and make recommendations on issues of public policy which affect people with disabilities.

National Down Syndrome Congress
7000 Peachtree-Dunwoody Blvd. South
Suite 100
Atlanta, GA 30328
800-232-6372
770-604-9500
770-604-9898 (FAX)
http://members.carol.net/~ndsc/
Down Syndrome information.

National Down Syndrome Society
666 Browning
New York, NY 10012-2317
800-221-4602
212-979-2873 (FAX)
http://www.ndss.org/
Down Syndrome information.

National Hearing Aid Society
800-521-5247
734-522-0205
16880 Middlebelt Suite 4
Lavonia, MI 48184
http://www.hearingihs.org/

National Information Center for Children and Youth with Disabilities (NICHCY)
PO Box 1492
Washington, D.C. 20013-1492
800-695-0285 (voice/TTY)
202-884-8200 (voice/TTY)
202-884-8441 (FAX)
nichcy@aed.org
http://www.nichcy.org/
A national information and referral center that provides information on disabilities and disability-related issues for families, educators, and other professionals related to children and youth.

National Information Center on Deafness (NICD)
Gallaudet University
800 Florida Avenue NE
Washington, D.C. 20002-3695
http://www.gallaudet.edu/~nicd
A centralized source of accurate, up-to-date, objective information on topics dealing with deafness and hearing loss.

National Institute on Deafness and Other Communication Disorders Clearinghouse (NIDCD)
PO Box 37777
Washington, D.C. 20013-7777
800-241-1055
800-241-1044
http://www.nih.gov/nidcd/
NIDCD facilitates and enhances the dissemination of information in the following areas: hearing, balance, smell, taste, voice, speech, and language.

National Institute on Disability & Rehabilitation Research (NIDRR)
http://www.ed.gov/offices/OSERS/NIDRR/
Research on disabilities.

National Library Service for the Blind and Physically Handicapped (NLS)
Library of Congress
Washington, D.C. 20542
202-707-5100
202-707-0744 (TTY)
202-707-0712 (FAX)
http://www.loc.gov/nls
NLS administers a free library program of Braille and recorded materials circulated to eligible borrowers through a nationwide network of cooperating libraries. A list of the cooperating libraries is located at http://lcweb.loc.gov/nls/libs.html.

National Multiple Sclerosis Society
733 Third Avenue
New York, NY 10017
800-344-4867
212-747-0004 (FAX)
http://www.nmss.org/
Information on Multiple Sclerosis.

National Organization on Disability (NOD)
910 Sixteenth Street NW Suite 600
Washington, D.C. 20006
202-293-7999
202-293-5960
202-293-5968 (TTY)
http://www.nod.org/
Promotes the fuller participation of Americans with disabilities in all aspects of community life.

National Prevention Information Network (NPIN)
CDC National Prevention Information Network
P.O. Box 6003
Rockville, MD 20849-6003
1-800-458-5231
1-888-282-7681 (Fax)
1-800-243-7012 (TTY)
info@cdcnpin.org
http://www.cdcnpin.org/
The Centers for Disease Control and Prevention (CDC) National Prevention Information Network (NPIN) develops, identifies, and collects information on the prevention, treatment, and control of HIV/AIDS, sexually transmitted diseases (STDs), and tuberculosis (TB), and makes this information available to healthcare providers, patients, grassroots community organizations, and organizations working in prevention, research, and support services.

National Rehabilitation Information Center (NARIC)
Serving the Nation's Disability Community
8455 Colesville Road Suite 935
Silver Spring, MD 20910-3319
800-227-0216 (voice/TTY)
301-588-9284
301-587-1967 (FAX)
http://www.naric.com/
Resource library for people with disabilities.

National Spinal Cord Injury Association
800-962-9629
http://users.erols.com/nscia/
Resources for those with Spinal Cord Injuries.

President's Committee on Employment for Persons with Disabilities
1111 20th Street NW
Washington, D.C. 20036
202-653-5044
http://www50.pcepd.gov/pcepd/
Concerned with the broad spectrum of employment of persons with disabilities.

Recording for the Blind & Dyslexic (RFB&D)
20 Roszel Road
Princeton, NJ 08540
609-452-0606
800-221-4792 (Book orders only)
http://www.rfbd.org/
RFB provides taped educational books free on loan, books on diskette.

Registry of Interpreters of the Deaf (RID)
8719 Colesville Road Suite 310
Silver Spring, MD 20910
301-608-0050
301-608-0508 (FAX)
http://www.rid.org/
A membership organization which includes professional interpreters and transliterators. Interpretation of American Sign Language and the transliteration of English.

Rehabilitation Engineering and Assistive Technology Society of North America (RESNA)
1700 North Moore Street - Suite 1540
Arlington, VA 33209-1903
703-524-6630 (FAX)
http://www.resna.org/
Resources for Research on Disabilities

University of Kansas Department of Special Education
http://www.sped.ukans.edu/
Research information.

SERI: Special Educational Resources on the Internet
http://www.hood.edu/seri/serihome.htm
Resources addressing attention deficit disorder, autism, behavior disorders, hearing impairment, learning disabilities, mental retardation, physical and health disorders, speech impairment, and vision impairment.

Spina Bifida Association of America
4590 MacArthur Blvd., NW, Suite 250
Washington, DC 20007-4226
800-621-3141
202-944-3285
202-944-3295 (FAX)
http://www.sbaa.org/
Spina Bifida information.

Tech Act Programs
703-524-6686
703-524-6639 (TTY)
http://www.resna.org/taproject/index.html
The 1988 Technology-related Assistance Act and its 1993 amendments provide federal funding to help states establish program to promote the provision of technology-related assistance for people with disabilities. Contact RESNA for more information about the Tech Act program in your state.

U.S. Department of Justice Americans with Disabilities Act Home Page
800-514-0301
800-514-0383 (TTY)
http://www.usdoj.gov/crt/ada/adahom1.htm

United Cerebral Palsy Associations, Inc.
1660 C Street NW
Washington, DC 20036-5602
800-872-5827
202-776-0414
ucpnatl@ucpa.org
http://www.ucpa.org/
Information and resources related to Cerebral Palsy.

Trace Research & Development Center
University of Wisconsin-Madison
5901 Research Park Blvd.
Madison, WI 53719-1252
608-262-6966
608-263-5408 (TTY)
608-262-8848 (FAX)
web@trace.wisc.edu
http://trace.wisc.edu/
An interdisciplinary research, development and resource center on technology and disability "to advance to ability of people with disabilities to achieve their life objectives through the use of communication, computer and information technologies."

WebABLE
http://www.webable.com/
A searchable directory for disability-related Internet resources. At the home page, choose SEARCH WebABLE.

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GLOSSARY

Accessible: In the case of a facility, readily usable by a particular individual; in the case of a program or activity, presented or provided in such a way that a particular individual can participate, with or without auxiliary aids(s); in the case of electronic resources, accessible with our without adaptive computer technology.

Access Barriers: Any obstruction that prevents people with disabilities from using standard facilities, equipment and resources.

Accessible Web Design: Creating World Wide Web pages according to universal design principles to eliminate or reduce barriers, including those that affect people with disabilities and others.

Accommodation: An adjustment to make a program, facility, or resource accessible to a person with a disability.

Adaptive Technology: Hardware or software products that provide access to a computer that is otherwise inaccessible to an individual wit a disability.

ALT attribute: HTML code that works in combination with graphical tags to provide alternative text for graphical elements.

Americans with Disabilities Act of 1990 (ADA): A comprehensive federal law that prohibits discrimination on the basis of disability in employment, public services, public accommodations and services operated by private entities, and telecommunications.

American Standard Code for Information Interchange (ASCII): Standard for unformatted text which enables transfer of data between platforms and computer systems.

Applet: Computer program that runs from within another application.

Assistive Technology: Technology used to assist a person with a disability, e.g. wheelchair, handsplints, computer-related equipment.

Auxiliary Aids and Services: Includes a) qualified interpreters or other effective methods of making aurally delivered materials available to individuals with hearing impairments; b) qualified readers, taped texts, or other effective methods of making visually delivered materials available to individuals with visual impairments; c) acquisition or modification of equipment or devices; and d) other similar services and actions (Americans with Disabilities Act of 1990).

Binary Files: Electronic files with formatting information that is software dependent.

Braille: System of embossed characters formed by using a Braille cell, a combination of six dots consisting of two vertical columns of three dots each. Each simple Braille character is formed by one or more of these dots and occupies a full cell or space.

Browser: A program that runs on an Internet-connected computer and provides access to the World Wide Web. Web browsers may be: text-only such as Lynx or graphical such as Internet Explorer and Netscape Navigator.

Captioned Film or Videos: Transcription of the verbal portion of films or videos displayed to make them accessible to people who are deaf.

Closed Circuit TV Magnifier (CCTV): Camera used to magnify books or other materials to a monitor.

Compensatory tools: Adaptive computing systems that allow people with disabilities to use computes to complete tasks that they would have difficulty doing without a computer, e.g. reading, writing, communication, accessing information.

Digital: Computer formatted data or information.

Disability: Physical or mental impairment that substantially limits on or more major life activity; a record of such an impairment; or being regarded as having such an impairment (Americans with Disabilities Act of 1990).

Discrimination: Act of making a difference in treatment or favor on basis other than individual merit.

Dymo Labeller: A device used to create raised print or Braille labels.

Electronic information: Any digital data for use with computers or computer networks including disks, CD-ROMs, World Wide Web resources.

Facility: All or any portion of a physical complex, including buildings, structures, equipment, grounds, roads, and parking lots.

FM Sound Amplification System: Electronic amplification system consisting of three components: a microphone/transmitter, monaural FM receiver and a combination charger/carrying case. It provides wireless FM broadcast from a speaker to a listener who has a hearing impairment.

Frame tags: A means of displaying web pages. The browser reads the frame tags and produces an output that subdivides output within a browser into discrete windows.

Graphical User Interface (GUI): Program interface that presents digital information and software programs in a image-based format as compared to a character-based format.

Hardware: Physical equipment related to computers.

Hearing Impairments: complete or partial loss of ability to hear caused by a variety of injuries or diseases including congenital defects. Frequent limitations including difficulties in understanding language or other auditory messages and/or in production of understandable speech are possible.

Helper: An external program that can be called up by a Web browser to display specially formatted material, such as word processed documents, spreadsheet documents or video/sound pieces. The Helper program is launched by the Web browser as a separate application to view or play the file.

Host: Any computer which holds Internet resources for access by others, or the computer that maintains your Internet access and electronic mail account.

HyperText Markup Language (HTML): A set of conventions for marking portions of a document so that, when presented on a computer screen, each portion appears with a distinctive format. HTML is the markup language that determines the appearance of documents on World Wide Web pages.

HTML validation: Process that analyzes an HTML document in comparison to standard HTML rules, identifying errors and non-standard codes.

HyperText Transfer Protocol (HTTP): Communication protocol used by the World Wide Web to transfer text, graphics, audio and video.

Hypertext: A method of preparing and publishing text, ideally suited to the computer, in which readers can choose their own paths through the material. Within the hypertext you have hyperlinks. When a reader clicks on a hyperlink the hypertext software takes the reader to a different screen. The process of navigating this way is called browsing. The World Wide Web is a hypertext system on a global scale.

Image map: Picture or graphic on a Web page in which hyperlinks are embedded.

Input: Any method by which information is entered into a computer.

Internet: Computer network connecting government, education, commercial, other organization and individual computer systems.

Interpreter: Professional person who assists a deaf person in communication with hearing people.

Java: Programming language used to create programs or applets that work with some World Wide Web browsers to include features with animation or other characteristics not available through standard HTML.

Keyboard emulation: Uses hardware and/or software in place of a standard keyboard.

Kinesthetic: Refers to touch based feedback.

Large Print Books: Most ordinary print is six to ten points in height (about 1/16 to 1/8 of an inch). Large type is 14 to 18 points (about 1/8 to 1/4 of an inch) and sometimes larger. The format of large print books is also proportionately larger (usually 8 1/2 x 11 inches).

Link: a connection between two electronic files or data items.

Lynx: Text-based World Wide Web browser.

Macro: A mini-program that, when run within an application, executes a series of predetermined keystrokes and commands to accomplish a specific task. Macros can automate tedious and often-repeated tasks or create special menus to speed data entry.

Mainstreaming: The inclusion of disabled persons, with or without special accommodations, in programs, activities, and facilities with non-disabled persons.

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Major life activities: Functions such as caring for oneself, performing manual tasks, walking, seeing, hearing, speaking, breathing, learning, working, and participating in community activities (Americans with Disabilities Act of 1990).

Multimedia: A computer-based method of presenting information by using more than one medium of communication, such as text, graphics, and sound.

Nemeth code: Braille encoding with cells for some math and science symbols.

Optical Character Recognition (OCR): Machine recognition of printed or typed text. Using OCR software with a scanner, a printed page can be scanned and the characters converted into text in an electronic format.

Output: Any method of displaying or presenting electronic information to the user through a computer monitor or other device.

Portable Document Format (PDF): The file format for representing documents in a manner that is independent of the original application software, hardware and operating system used to create the documents.

Physical or mental impairment: Any physiological disorder or condition, cosmetic disfigurement, or anatomical loss affecting one or more of the following body systems: neurological; musculoskeletal; special sense organs; respiratory, including speech organs; cardiovascular; reproductive; digestive; genitourinary; hemic and lymphatic; skin; and endocrine; or any mental or psychological disorder, such as mental retardation, organic brain syndrome, emotional or mental illness, and specific learning disabilities (Americans with Disabilities Act of 1990).

Plug-ins: Programs that work within a browser to alter, enhance, or extend the browser's operation. They are often used for viewing video, animation or listening to audio files.

Proprietary software: Privately owned; based on trade secrets, privately developed technology, or specifications that the owner refuses to divulge, thus preventing others from duplicating a product or program unless an explicit license is purchased. The opposite of proprietary is open (privately developed but publicly published and available for emulation by others).

Qualified individual with a disability: An individual with a disability who, with or without reasonable modification to rules, policies, or practices, the removal of architectural, communication, or transportation barriers, or the provision of auxiliary aids and services, meets the essential eligibility requirements for the receipt of services or the participation in programs or activities provided by a public entity (Americans with Disabilities Act of 1990).

Reader: Volunteer or employee of a blind or partially sighted individual who reads printed material in person or records to audio tape.

Screen reader: A text-to-speech system intended for use by users who are blind or have low vision that speaks the text content of a computer display.

Server: Any computer that stores information that is available to other users, often over the Internet.

Sign language: Manual communication commonly used by deaf. Sign language is not universal; deaf persons from different countries speak different sign languages. The gestures or symbols in sign language are organized in a linguistic way. Each individual gesture is called a sign. Each sign has three distinct parts: The handshape, the position of the hands, and the movement of the hands. American Sign Language (ASL) is the most commonly used sign language in the United States.

Specific Learning Disability (SLD): Disorder in one or more of the basic psychological processes involved in understanding or in using language, spoken or written, which may manifest itself in difficulties listening, thinking, speaking, reading, writing, spelling, or doing mathematical calculations. Frequent limitations include hyperactivity, distractibility, emotional instability, visual and/or auditory perception difficulties and/or motor limitations, depending on the type(s) of learning disability.

Speech output system: A system that provides the user with a voice alternative to the text presented on the computer screen.

Speech Impairment: Problems in communication and related areas such as oral motor function, ranging from simple sound substitutions to the inability to understand or use language or use the oral-motor mechanism for functional speech and feeding. Some causes of speech and language disorders include hearing loss, neurological disorders, brain injury, mental retardation, drug abuse, physical impairments such as cleft lip or palate, and vocal abuse or misuse.

Standard HTML: Version of HTML accessible by all browsers.

Sticky keys: Enables a computer user to do multiple key combinations on a keyboard using only one finger at a time. The sticky keys function is usually used with the Ctrl, Alt, and Shift keys. Simultaneous keystrokes can be entered sequentially.

Tag: HTML code that prescribes the structure and formatting of Web pages.

Telecommunications Device for the Deaf (TDD) or Teletypewriter (TTY): A device which enables someone who has a speech or hearing impairment to use a telephone when communicating with someone else who has a TDD/TTY. TDD/TTYs can be used with any telephone, and one needs only a basic typing ability to use them.

Trackball: A pointing device consisting of a ball housed in a socket containing sensors to detect the rotation of the ball – like an upside down mouse. The user rolls the ball with his thumb or the palm of his hand to move the pointer.

Traumatic Brain Injury (TBI): Open and closed head injuries resulting in impairments in one or more areas, such as cognition; language; memory; attention; reasoning; abstract thinking; judgment; problem-solving; sensory, perceptual, and motor abilities; psychosocial behavior; physical functions; information processing; and speech. The term does not apply to brain injuries that are congenital or degenerative, or brain injuries induced by birth trauma.

Universal Design: Designing programs, services, tools, and facilities so that they are usable, without modification, by the widest range of users possible, taking into account a variety of abilities and disabilities.

Universal Resource Locator (URL): Address used to locate a specific resource on the Internet. DO-IT's URL is *http://www.washington.edu/doit/*.

Vocational Rehabilitation Act of 1973: Act prohibiting discrimination on the basis of disability which applies to any program that receives federal support. Section 504 of the Act is aimed at making educational programs and facilities accessible to all students. Section 508 of the Act requires. that electronic office equipment purchased through federal procurement meets disability access guidelines.

Voice input system: A computer-based system that allows the operator to control the system using his/her voice.

Vision impairments: Complete or partial loss of ability to see, caused by a variety of injuries or diseases including congenital defects. Legal blindness is defined as visual acuity of 20/200 or less in the better eye with correcting lenses, or widest diameter of visual field subtending an angular distance no greater than 20 degrees.

World Wide Web (WWW, W3, or Web): Hypertext and multimedia gateway to the Internet.

The materials included in this section can be used for individual study by science, mathematics, and special education teachers. They can also help you develop a presentation to deliver as a pre-conference workshop, conference presentation, or teacher workshop or presentation for your school or district.

Overhead Transparency Templates

Included are black and white templates that can be used as references or copied onto transparencies for use in presentations. A large number of transparencies are included to optimize custom presentation options. Pick and choose which templates work best for your audience and meeting time.

Videotape Presentations

Seven videotape presentations are included on the enclosed videotape. They are titled:

- *Working Together: Faculty and Students with Disabilities*
- *Opening Doors: Mentoring on the Internet*
- *Equal Access: Computer Labs*
- *Working Together: People with Disabilities and Computer Technology*
- *World Wide Access*
- *Working Together: Science Teachers and Students with Disabilities*
- *The Winning Equation: Access + Attitude = Success in Math and Science*

Handout Templates

Black and white templates of the following DO-IT handouts can be copied for distribution to others in your school, at conferences, or during presentations. They are included in the pouch in the back cover of this notebook.

- *Working Together: Faculty and Students with Disabilities*
- *Meet the Speakers in the Videotape — Working Together: Faculty and Students with Disabilities*
- *Opening Doors: Mentoring on the Internet*
- *Meet the Speakers in the Videotape — Opening Doors: Mentoring on the Internet*
- *Equal Access: Computer Labs*
- *Working Together: People with Disabilities and Computer Technology*
- *Meet the Speakers in the Videotape — Working Together: People with Disabilities and Computer Technology*
- *World Wide Access: Accessible Web Design*
- *Meet the Speakers in the Videotape — World Wide Access*
- *Working Together: Science Teachers and Students with Disabilities*
- *Meet the Speakers in the Videotape — Working Together: Science Teachers and Students with Disabilities*
- *The Winning Equation: Access + Attitude = Success in Math and Science*

Electronic Presentation

Materials in electronic form are available at DO-IT's World Wide Web site at *http://www.washington.edu/doit/*. Here you will find many of the materials included in this packet, as well as additional examples of Web pages that use universal design principles. With a live Internet connection, you can use the site during a presentation. Or, you may prefer to download the files for an off-line presentation utilizing one of many .browser capture programs (e.g., Browser Buddy, WebWhacker). If you choose this presentation method, be sure to have the traditional overhead transparencies ready as a backup in case of Internet connection or computer failure!

Permission is granted to reproduce printed materials and videotape presentations for non-commercial, educational purposes as long as proper credit is given to the source.

Accommodating Students with Disabilities in Math and Science Classes

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The number of students with disabilities will increase because of:

- advances in medical technology.
- advances in adaptive technology.
- increased awareness.
- increased educational support.
- older average age.

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Issues

Preparation

Access

Acceptance

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Section 504 of the 1973 Rehabilitation Act and 1990 Americans with Disabilities Act

No otherwise qualified individual with a disability shall, solely by reason of his/her disability, be excluded from the participation in, be denied the benefits of, or be subjected to discrimination under any program or activity of a public entity.

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Person with a disability = any person who

- has a physical or mental impairment which substantially limits one or more major life activities including walking, seeing, hearing, speaking, breathing, learning, and working;

- has a record of such an impairment; or

- is regarded as having such an impairment.

Examples of Disabilities

Spinal cord injuries
Loss of limbs
Multiple Sclerosis
Muscular Dystrophy
Cerebral Palsy
Hearing impairments
Visual impairments
Speech impairments
Specific learning disabilities
Head injuries
Psychiatric disorders
Diabetes
Cancer
AIDS

DO·IT

Low Vision

Blindness

Hearing Impairments

Specific Learning Disabilities

Mobility Impairments

Health Impairments

DO·IT

Low Vision

- Large print handouts, signs, equipment labels
- TV monitor connected to microscope to enlarge images
- Class assignments in electronic format
- Computer with enlarged screen images
- Seating where the lighting is best

Blindness

- Audio-tape, Braille, or electronic lecture notes, handouts, texts
- Describe visual aids
- Raised-line drawings and tactile models of graphic materials
- Adaptive lab equipment (e.g., tactile timers, talking thermometers, calculators, light probes)
- Computers with optical character readers, voice output, Braille screen displays, Braille embossers

DO-IT

Hearing and Speech Impairments

- Interpreters, real-time captions, FM systems, note takers
- Face student when speaking
- Written assignments, lab instructions, demonstration summaries
- Visual aids, visual warning systems for lab emergencies
- Repeat questions and statements from other students
- Electronic mail

DO·IT

Specific Learning Disabilities

- Note takers and/or audiotaped class sessions
- Extra exam time; alternative testing arrangements
- Visual, aural, and tactile demonstrations incorporated into instruction
- Course and lecture outlines
- Computers with voice output, spell checkers, grammar checkers, thesaurus, specialized software

DO·IT

Mobility Impairments

- Group assignments, note takers/ scribes, lab assistants
- Extra exam time, alternative testing arrangements
- Classrooms, labs, field trips in accessible locations
- Adjustable tables, lab equipment located within reach
- Class materials in electronic format
- Computers with special input devices (e.g., voice, Morse code, alternative keyboards)

DO·IT

Health Impairments

- Note takers, audio-taped class sessions
- Flexible attendance requirements
- Extra exam time, alternative testing arrangements
- Assignments in electronic formats
- Electronic mail

General Suggestions

- Talk with student
- Select materials early
- Materials in electronic formats
- Alternative testing arrangements
- Use school/district services
- Be flexible

Service Guidelines

- Show respect and consideration.
- Ask before helping.
- Talk directly to the person.
- Refer to disability only if relevant.
- Avoid negative descriptions.
- Refer to the person first.

Success Stories

• Ben	mobility impairment
• Sarah	learning disability
• Anna	blind
• Shane	mobility/speech impairment
• Sherri	low vision
• Katie	hearing impairment

Universal design

=

designing services and resources for people with a broad range of abilities and disabilities.

DO·IT

Accessible Labs

- physical environment
- adaptive technology
- electronic resources

Computers

+

Adaptive Technology

+

Electronic Resources

=

Opportunities

DO·IT

Physical Environment

- wheelchair accessible
- doorways 32" wide
- thresholds no higher than 1/2 inch
- aisles clear & wide
- ramps & elevators
- large print & Braille signs/ markers
- study rooms & hearing protectors

DO-IT

Problem		Solution
access to computers	→	adaptive technology
access to electronic resources	→	universal design principles

Computers assist people with:

- low vision
- blindness
- hearing impairments
- speech impairments
- specific learning disabilities
- mobility impairments
- health impairments

DO·IT

Low Vision

- large print signs, handouts, labels
- good lighting
- large print key labels
- large monitors
- software to enlarge screen images
- software to adjust screen colors

Blindness

- Braille and taped materials
- Braille labels
- computers with voice output
- Braille screen displays
- scanners and optical character recognition
- Braille printers
- Internet accessible services/resources

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Hearing/Speech Impairments

- computers with visual output
- electronic mail
- speech synthesizers

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Specific Learning Disabilities

- staff assistance
- quiet work areas
- computers with voice output
- spelling/grammar checkers, thesauruses
- word prediction software
- software to enlarge screen images
- large monitors

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Mobility Impairments

- adjustable tables
- keyboard modifications
- keyboard guards and layouts
- alternative keyboards and mice
- Internet services/ resources

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Health Impairments

- electronic mail
- Internet accessible services/ resources

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Adaptive Technology

- hardware/software
- easy/difficult to implement
- easy/difficult to use
- inexpensive/expensive
- generic/unique
- stand alone/networked

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Getting Started!

- adjustable tables
- large print key labels
- screen enlargement software
- large monitors
- speech output
- Braille conversion software and printer
- trackballs, wristrests, keyguards

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Some Internet users:

- cannot see graphics.
- cannot hear audio.
- have difficulty with unorganized sites.
- use older equipment, slow connections.
- use adaptive technology.

Universal design

=

design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design.

Universal Design Principles

- equitable use
- flexible use
- simple and intuitive use
- information duplicated in several formats
- low physical effort

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Accessible Web Design Principles

- Simple backgrounds with contrast
- Standard HTML
- Note about accessibility
- Text alternatives
- Use special features with care
- Test

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Access to Math and Science

Gaining Knowledge

Demonstrating Knowledge

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Four-Step Model

1. What does the task/ assignment require?
2. What physical, sensory, and cognitive skills are needed?
3. What components of the task require accommodation?
4. What accommodation options exist?

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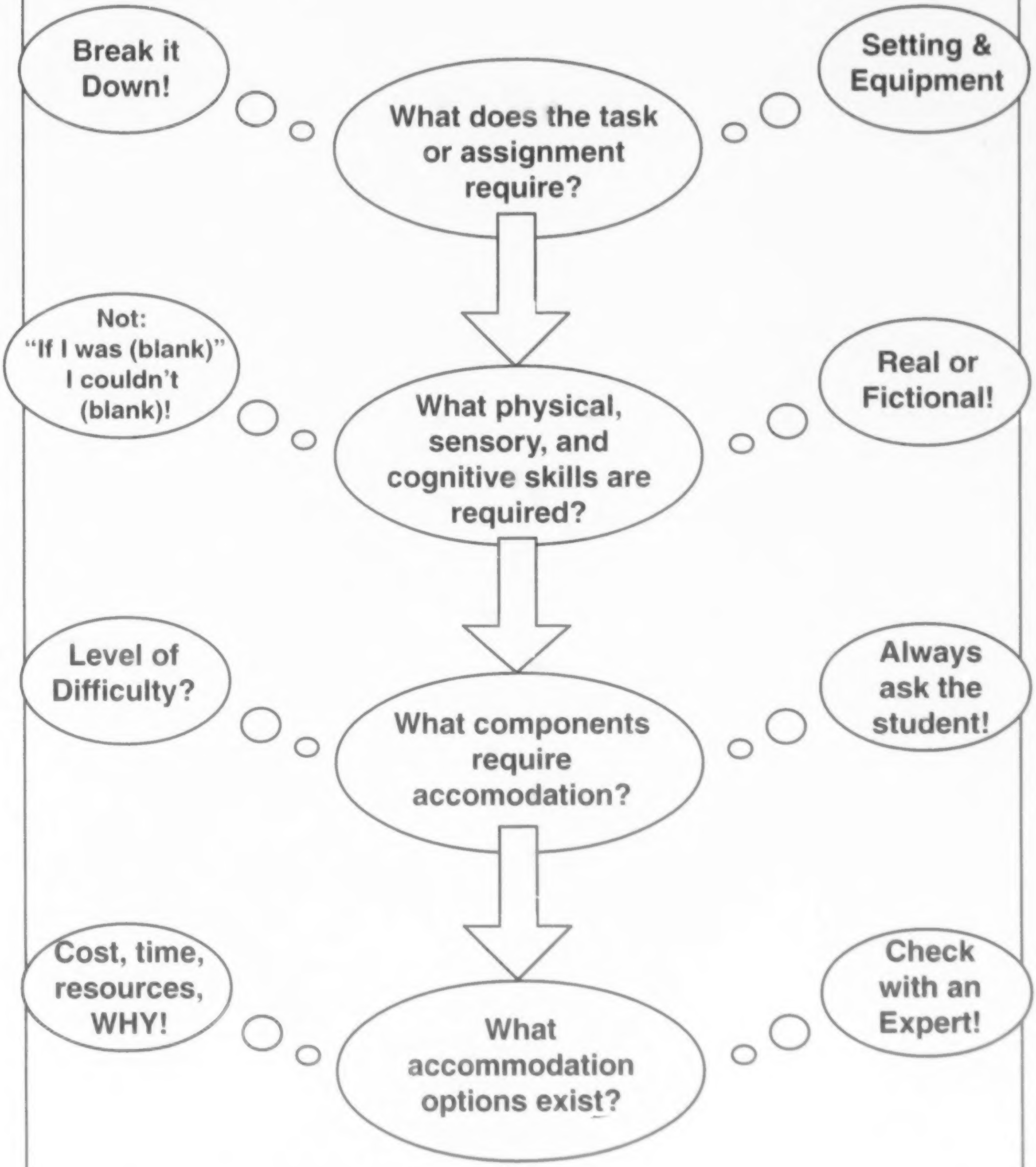
Four-Step Accommodation Model



What does the task or assignment require?

Break it Down!

Setting & Equipment

What physical, sensory, and cognitive skills are required?

Not: "If I was (blank)" I couldn't (blank)!

Real or Fictional!

What components require accomodation?

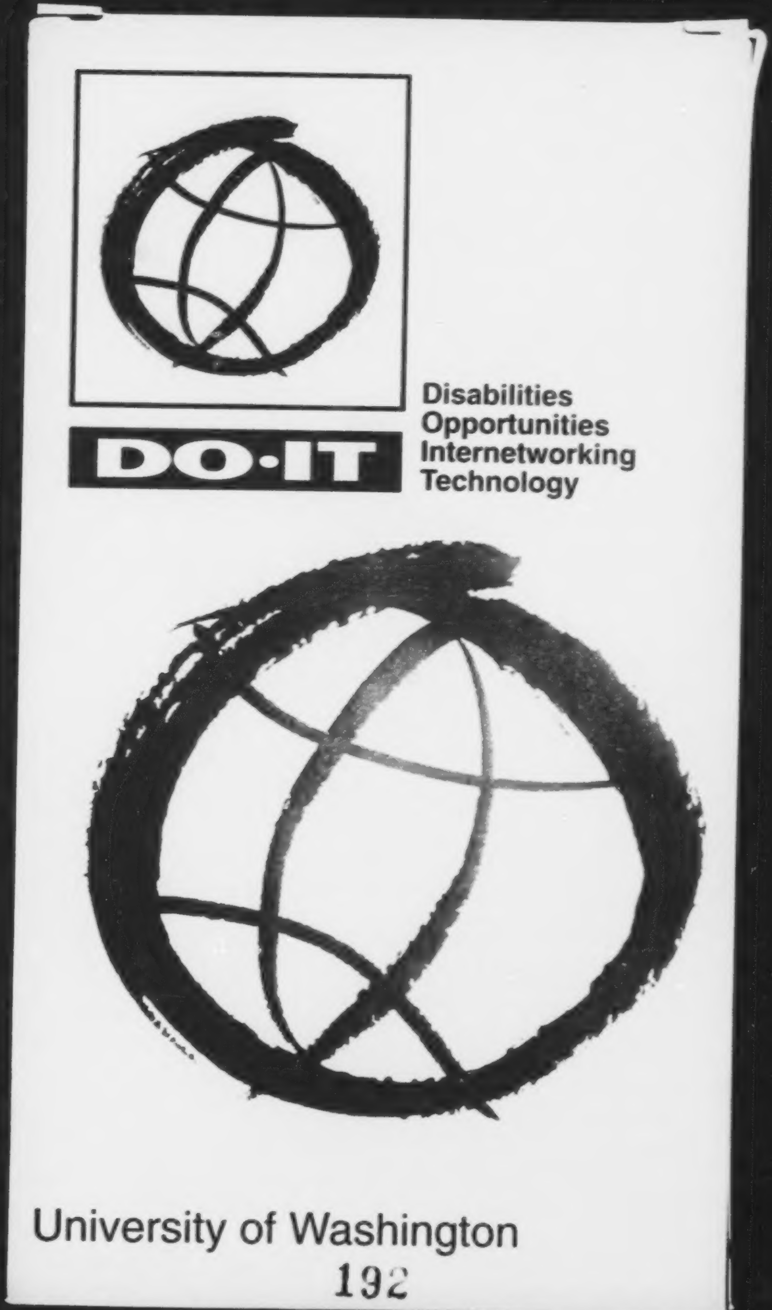
Level of Difficulty?

Always ask the student!

What accommodation options exist?

Cost, time, resources, WHY!

Check with an Expert!



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Disabilities
Opportunities
Internetworking
Technology

University of Washington

DO-IT

DO-IT (Disabililties, Opportunities, Internetworking, and Technology) undertakes activities to increase the participation of individuals with disabilities in academic programs, careers, and other life activities.

1. Working Together: Faculty and Students with Disabilities 00:00:00
2. Opening Doors: Mentoring on the Internet 00:08:47
3. Equal Access Computer Labs 00:23:32
4. Working Together: People with Disabilities & Computer Technology 00:34:07
5. World Wide Access 00:48:42
6. Working Together: Science Teachers and Students with Disabilities 01:01:00
7. The Winning Equation 01:13:37

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DO·IT

Programs and Resources

Disabilities
Opportunities
Internetworking
Technology

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1997 THE PRESIDENTIAL AWARD FOR EXCELLENCE IN SCIENCE, MATHEMATICS, AND ENGINEERING MENTORING
for embodying excellence in mentoring underrepresented students and encouraging their significant achievement in science, mathematics, and engineering.

1995 NATIONAL INFORMATION INFRASTRUCTURE AWARD - EDUCATION
for those whose achievements demonstrate what is possible when the powerful forces of human creativity and technologies are combined.

Are you:

- a student with a disability who wants to attend college and pursue a career?
- someone who wants to communicate with and encourage other people with disabilities?
- a teacher or faculty member who wants to more fully include students with disabilities in your classes?
- a student with a disability who wants to gain work experiences while still in school?
- a 2-year college student who wants to transition to a 4-year post-secondary program?
- someone who wants to learn how technology can empower people with disabilities?
- a person who wants to help people with disabilities maximize independence, productivity, and participation in all life experiences?

If you've answered yes to any of these questions, YOU should DO-IT!

"Some kids with disabilities have expectations that are lower than they need to be. In DO-IT, we try to change that."

Sheryl Burgstahler, Ph.D.
DO-IT Director

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Many capable individuals with disabilities face challenges as they pursue academics and careers. They are underrepresented in many challenging and rewarding career fields, including science, engineering, mathematics, and technology. DO-IT (Disabilities, Opportunities, Internetworking, and Technology) serves to increase the participation of individuals with disabilities in challenging academic programs and careers. It promotes the use of computer and networking technologies to increase independence, productivity, and participation in education and employment.

DO-IT has received national and regional awards including the National Information Infrastructure Award in Education, the King County Adult Service Agency Award, an Outstanding Program Award from the Washington Association on Post Secondary Education Disability (WAPED), the HealthyWay Best of the Web Award, and the President's Award for Excellence in Science, Mathematics, and Engineering Mentoring of underrepresented groups. It was also showcased in the 1997 President's Summit on Volunteerism and the 1996 NSF Dynamic Partnerships invitational conference.

Who Does It?

The following people are key players on the DO-IT team.

DO-IT Scholars are college-capable high school students with disabilities who are self-motivated and have leadership potential. DO-IT Scholars are loaned computers, modems, software, and adaptive technology for use in their homes. They learn to use the Internet to access information and to communicate with others. DO-IT Scholars gain valuable academic, career, and personal insight by communicating electronically with each other and with DO-IT Mentors. DO-IT Scholars attend two live-in summer study programs at the University of Washington and participate in work-based learning experiences. They experience college life and prepare for success in college and careers.

DO-IT Pals are high school students with disabilities who participate in an electronic community to support their academic and career goals. They provide their own computer systems and Internet access, usually through their home or school.

DO-IT Ambassadors are DO-IT Scholar high school graduates who continue to support DO-IT efforts, participate in the electronic community, and mentor younger Scholars and Pals.

DO-IT Campers are participants in selected summer camps for children and youth with disabilities. DO-IT staff travel to these camps to teach Internet and college transition skills.

DO-IT Mentors include college students, faculty, and professionals in a wide variety of career fields. Many have disabilities themselves. Mentors help younger DO-IT participants succeed in college and employment as they communicate via electronic mail and during program activities.

DO-IT Staff and Volunteers coordinate programs, electronic communications, research and dissemination.

DO-IT Workshops, Presentations, & Events

DO-IT sponsors programs and delivers presentations and workshops to enhance the lives of people with disabilities throughout the world. DO-IT activities are hosted at conferences, universities, K-12 schools, corporations, state agencies, and professional organizations.

Adaptive Technology — information about and demonstrations of adaptive computer technologies are available to people who have disabilities. A college credit course is offered over the Internet.

College Transition — helping pre-college students with disabilities, parents, teachers, and service providers develop college preparation and success strategies.

Disability Awareness for Teachers/Faculty/Staff — creative and practical approaches for ensuring access to educational opportunities for all students.

Library and Lab Access — how to make libraries, computer labs, and science labs accessible to people with disabilities.

Access to Employment — making cooperative education programs, internships, and other employment opportunities accessible to people with disabilities.

Universal Design — how World Wide Web (WWW) and other electronic resources can be made accessible to people with disabilities.

Electronic Communities — how to create and sustain successful communities on the Internet.

Tailor-Made — presentations tailored to audiences interested in education, transition, employment, and technology for people with disabilities.

DO-IT resources on the Internet facilitate communication and provide access to information.

To contact staff, request publications, or ask questions about the program, send electronic mail to:

To send a message to DO-IT Scholars, DO-IT Pals, or DO-IT Mentors, send electronic mail to the appropriate address:

To discuss issues pertaining to individuals with disabilities in their pursuit of science, engineering, mathematics, and technology academic programs and careers, subscribe to the doitsem LISTPROC discussion list by sending electronic mail to *listproc@u.washington.edu*. In the message text type:

For information about DO-IT programs, publications, and resources, access DO-IT's World Wide Web home page. Topics focus on access issues for people with disabilities, including access to adaptive technology, science, mathematics, engineering, technology, and post-secondary education, and careers. Most of the printed materials listed in this publication as well as a useful set of links to other Internet resources are available at this site. Point your Web browser to:

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DO-IT distributes materials to those who wish to undertake similar activities or enhance existing school, post-secondary, and employment programs. It maintains a large collection of free publications, including those listed below.

DO-IT Programs

DO-IT Programs and Resources

Disabilities, Opportunities, Internetworking, & Technology = DO-IT!

DO-IT Annual Report

DO-IT News, project newsletter

DO-IT Scholars

DO-IT Pals

DO-IT Campers

DO-IT Snapshots, pictures and bios of DO-IT participants

Guidelines for DO-IT Scholars and Ambassadors

Guidelines for DO-IT Summer Study Instructors

Poster: *When it comes to science, engineering, and mathematics... we can DO-IT!*

DO-IT Volunteer Application/Information Form

DO-IT Contribution Submission Form

Technology

Equal Access: Computer Labs

Working Together: People with Disabilities and Computer Technology

World Wide Access, designing accessible Web pages

Adaptive Technology used by DO-IT Scholars

Resources in the UW Adaptive Technology Lab

Computing and Networking Services for Students with Disabilities: How do Community Colleges Measure Up?

Making Library Resources Accessible to People with Disabilities

Disability-Related Resources on the Internet

Opening Doors: Mentoring on the Internet

Peer Support: What Role Can the Internet Play?

Peer-to-Peer Relationships on the Internet: Advancing the Academic Goals of Students with Disabilities

FREE PRINTED PUBLICATIONS

DO-IT PROGRAMS

- ☐ DO-IT Programs and Resources, project overview
- ☐ Disabilities, Opportunities, Internetworking, & Technology = DO-IT!
- ☐ DO-IT Annual Report
- ☐ DO-IT News, project newsletter
- ☐ DO-IT Scholars
- ☐ DO-IT Pals
- ☐ DO-IT Campers
- ☐ DO-IT Snapshots, pictures and bios of DO-IT participants
- ☐ Guidelines for DO-IT Scholars and Ambassadors
- ☐ Guidelines for DO-IT Summer Study Instructors
- ☐ Poster: When it comes to science, engineering, and mathematics... we can DO-IT!
- ☐ DO-IT Volunteer Application/Information Form
- ☐ DO-IT Contribution Submission Form

TECHNOLOGY

- ☐ Equal Access: Computer Labs
- ☐ Working Together: People with Disabilities and Computer Technology
- ☐ World Wide Access, designing accessible Web pages
- ☐ Adaptive Technology used by DO-IT Scholars
- ☐ Resources in the UW Adaptive Technology Lab

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ORDER FORM

DO-IT Videotapes, Publications, and Training Materials

This order form lists free and low cost resources available through DO-IT. All videotapes are open captioned. They are also available with video description by request. Printed materials are available in large print, Braille, and electronic formats by request. Permission is granted to copy DO-IT videotapes and publications for noncommercial purposes as long as credit is given to the source.

NAME POSITION

ORGANIZATION

ADDRESS

PHONE E-MAIL

Submit form to DO-IT by mail, FAX, or electronic mail. If requesting materials for which there is a fee, enclose a check payable to the University of Washington (Federal ID # 91-6001537).

CONTACT INFORMATION

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VIDEOTAPES

- Equal Access: Computer Labs ($20)
- Working Together: People with Disabilities and Computer Technology ($20)
- World Wide Access ($20)
- Universal Access to Computing 3-Pack ($30)
- Opening Doors: Mentoring on the Internet ($20)
- Working Together: Science Teachers and Students with Disabilities ($20)
- The Winning Equation: Access + Attitude = Success in Math and Science ($20)
- Camp: Beyond Summer ($20)
- DO-IT Scholars (Free)
- College: You Can Do It! ($20)
- Moving On: The Two-Four Step ($20)
- Working Together: Faculty and Students with Disabilities ($20)
- It's Your Career ($20)
- Finding Gold: Hiring the Best and the Brightest ($20)
- All thirteen video presentations on one tape ($100)

TRAINING MATERIALS

- Universal Access: Electronic Resources in Libraries–PRESENTATION MATERIALS ($75)
- Working Together: Faculty and Students with Disabilities–PRESENTATION MATERIALS ($40)
- Internet at Camp: How to DO-IT–PROGRAM DEVELOPMENT MATERIALS ($50)
- Accommodating Students with Disabilities in Math and Science Classes–A RESOURCE FOR TEACHERS ($60)
- Career Development and Students with Disabilities–PRESENTATION MATERIALS ($60) Available 3/99

- Computing and Networking Services for Students with Disabilities: How do Community Colleges Measure Up?
- Making Library Resources Accessible to People with Disabilities
- Disability-Related Resources on the Internet
- Opening Doors: Mentoring on the Internet
- Peer Support: What Role Can the Internet Play?
- Peer-to-Peer Relationships on the Internet: Advancing the Academic Goals of Students with Disabilities
- Teaching on the Net: What's the Difference?
- Adaptive Computer Technology college course via the Internet
- Enhanced Learning Through Electronic Communities: A Research Review
- Beyond Summer: Conducting Internet Activities at Camp

ACADEMICS

- College: You Can Do It!
- Moving On: The Two-Four Step
- Distance Learning and the Information Highway
- Funding Strategies for Students with Disabilities
- Working Together: Faculty and Students with Disabilities
- Working Together: Science Teachers and Students with Disabilities
- The Winning Equation: Access + Attitude = Success in Math and Science

CAREERS

- Increasing the Representation of People with Disabilities in Science, Engineering, and Mathematics
- It's Your Career: Work-Based Learning Opportunities for Students with Disabilities
- Cooperative Education and Students with Disabilities
- Finding Gold: Hiring the Best and Brightest

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Teaching on the Net: What's the Difference?

Adaptive Computer Technology, distance learning college course via the Internet

Enhanced Learning Through Electronic Communities: A Research Review

Beyond Summer: Conducting Internet Activities at Camp

Academics

College: You Can DO-IT!

Moving On: The Two-Four College Transition

Distance Learning and the Information Highway

Funding Strategies for Students with Disabilities

Working Together: Faculty and Students with Disabilities

Working Together: Science Teachers and Students with Disabilities

The Winning Equation: Access + Attitude = Success in Math and Science

Careers

Increasing the Representation of People with Disabilities in Science, Engineering, and Mathematics

It's Your Career: Work-Based Learning Opportunities for Students with Disabilities

Cooperative Education and Students with Disabilities

Finding Gold: Hiring the Best and Brightest

Videotapes

Equal Access: Computer Labs ($20)
Making computer labs accessible to people with disabilities (11 minutes).

Working Together: People with Disabilities and Computer Technology ($20)
Adaptive technology and computer applications for people with disabilities (14 minutes).

World Wide Access ($20)
Making WWW pages and other electronic resources accessible to people with disabilities (12 minutes).

Universal Access to Computing 3-Pack ($30)
Packaged for school/college/library technology coordinators, three videos on one videotape—*Equal Access: Computer Labs, Working Together: People with Disabilities and Computer Technology*, and *World Wide Access* (37 minutes).

Opening Doors: Mentoring on the Internet ($20)
Students develop supportive relationships with adult mentors on the Internet (14 minutes).

Working Together: Science Teachers and Students with Disabilities ($20)
Successful students with disabilities suggest ways to make science activities more accessible to students (13 minutes).

The Winning Equation: Access + Attitude = Success in Math and Science ($20)
Learn strategies for fully including students with disabilities in science and math activities (15 minutes).

Camp: Beyond Summer ($20)
How to add Internet experiences to summer camp programs for children and youth with disabilities (9 minutes).

DO-IT Scholars (free)
DO-IT Scholars talk about the program for high school students with disabilities (11 minutes).

College: You Can DO-IT! ($20)
College students with disabilities and staff share advice for success in college (14 minutes).

Moving On: The Two-Four College Transition ($20)
Tips for making a successful transition, with special guidelines for students with disabilities (12 minutes).

Working Together: Faculty and Students with Disabilities ($20)
College students with disabilities and faculty share their experiences (9 minutes).

It's Your Career ($20)
College students with disabilities gain work-based learning experiences (13 minutes).

Finding Gold: Hiring the Best and the Brightest ($20)
Learn how staff and employers in cooperative education, internship, and other work-based learning programs can fully include participants with disabilities (5 minutes).

All Thirteen Video Presentations on one tape ($100)
This cost-saving option includes all related handouts.

Comprehensive Training Materials

Universal Access: Electronic Resources in Libraries

PRESENTATION MATERIALS ($75)

Includes the videotapes *Working Together: People with Disabilties and Computer Technology* and *World Wide Access* as well as printed support materials for delivering presentations to increase access to electronic information in libraries for people with disabilities.

Working Together: Faculty and Students with Disabilities

PRESENTATION MATERIALS ($40)

Includes videotape *Working Together: Faculty and Students with Disabilities* as well as printed support materials for delivering presentations to help increase the awareness of college faculty and staff regarding the potential contributions and accommodation needs of students with disabilities.

Internet at Camp: How to DO-IT

PROGRAM DEVELOPMENT MATERIALS ($50)

Training packet to help administrators of summer camps incorporate Internet activities into their programs. Includes the videotapes *Camp: Beyond Summer, Opening Doors: Mentoring on the Internet, Equal Access: Computer Labs, Working Together: People with Disabilities and Computer Technology*, and *World Wide Access*.

Accommodating Students with Disabilities in Math and Science Classes

A RESOURCE FOR TEACHERS ($60)

Comprehensive materials and resources to help science and math teachers fully include students with disabilities in their classes and labs. Includes the videotapes *Working Together: Faculty and Students with Disabilities, Working Together: Science Teachers and Students with Disabilities, The Winning Equation: Access + Attitude = Success in Math and Science, Working Together: People with Disabilities and Computer Technology, Equal Access: Computer Labs*, and *World Wide Access*, and *Opening Doors: Mentoring on the Internet*.

Career Development and Students with Disabilities

PRESENTATION MATERIALS ($60)

Comprehensive training materials to help staff and employers in cooperative education, internship, and other work-based learning programs accommodate participants with disabilities. Includes the videotapes *It's Your Career, Finding Gold: Hiring the Best and the Brightest, Working Together: People with Disabilities and Computer Technology*, and *Equal Access: Computer Labs*. Available 3/99.

The University of Washington is working to increase the representation of individuals with disabilities in science, engineering, mathematics, and technology academic programs and careers through project DO-IT (Disabilities, Opportunities, Internetworking, and Technology). Primary funding for the DO-IT program is provided by the National Science Foundation and the State of Washington. Additional grants have been received from NEC Foundation of America, the Seattle Foundation, the Telecommunications Funding Partnership, U.S. Department of Education (including the Fund for the Improvement of Postsecondary Education), US WEST Communications, Visio Corporation, The Washington State Office of Superintendent of Public Instruction, and an NSF Award for Mentoring. The University of Washington also contributes substantial resources to this project.

Additional Partners include:

DO-IT welcomes new partners to support project efforts. Consider providing mementos to participants; funding special events; providing financial stipends for travel or attendant care to students with a financial need; purchasing computers and adaptive technology for participants; funding the creation and distribution of a videotape or printed publication, providing work-based learning opportunities for students with disabilities; or funding a national or international DO-IT Scholars program. Volunteers are also needed to help with DO-IT activities. Contact the DO-IT office if you would like to contribute in any way.

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For further information, to be placed on the DO-IT mailing list, or to request materials in alternative format, contact:

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509-328-9331 (voice/TTY) Spokane office

Director: Sheryl Burgstahler, Ph.D.

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DO·IT

Working Together: Faculty and Students with Disabilities

Disabilities
Opportunities
Internetworking
Technology

Legal Issues

Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1990 prohibit discrimination against individuals with disabilities.

According to these laws, no otherwise qualified individual with a disability shall, solely by reason of his/her disability, be excluded from the participation in, be denied the benefits of, or be subjected to discrimination under any program or activity of a public entity.

"Qualified" with respect to post-secondary educational services, means "a person who meets the academic and technical standards requisite to admission or participation in the education program or activity, with or without reasonable modifications to rules, policies or practices; the removal of architectural, communication or transportation barriers; or the provision of auxiliary aids and services."

"Person with a disability" means "any person who 1) has a physical or mental impairment which substantially limits one or more major life activities [including walking, seeing, hearing, speaking, breathing, learning, and working], 2) has a record of such an impairment, or 3) is regarded as having such an impairment."

Disabilities covered by legislation include (but are not limited to) AIDS, Cancer, Cerebral Palsy, Diabetes, Epilepsy, head injuries, hearing impairments, specific learning disabilities, loss of limbs, Multiple Sclerosis, Muscular Dystrophy, psychiatric disorders, speech impairments, spinal cord injuries, and visual impairments.

Working Together: Faculty and Students

Faculty members are encouraged to be responsive to the pedagogical needs of all students. However, students with disabilities may have some additional educational needs which they should discuss with each faculty member. It is helpful to include a statement on the class syllabus inviting students who have disabilities to discuss academic needs. An example of such a statement is "If you have a documented disability and wish to discuss academic accommodations, please contact me as soon as possible."

The student with a disability is the best source of information regarding necessary accommodations. In post-secondary settings it is the student's responsibility to request special accommodation if desired, but a faculty member can make a student comfortable by inquiring about special needs.

Examples of Academic Accommodations

Disability	Accommodations
Low Vision	• Seating near front of class • Large print handouts, lab signs, and equipment labels • TV monitor connected to microscope to enlarge images • Class assignments made available in electronic format • Computer equipped to enlarge screen characters and images
Blindness	• Audio-taped, Brailled or electronic-formatted lecture notes, handouts, and texts • Verbal descriptions of visual aids • Raised-line drawings and tactile models of graphic materials • Braille lab signs and equipment labels, auditory lab warning signals • Adaptive lab equipment (e.g., talking thermometers and calculators, light probes, and tactile timers) • Computer with optical character reader, voice output, Braille screen display and printer output
Hearing Impairment	• Interpreter, real-time captioning, FM system, notetaker • Open or closed-captioned films, use of visual aids • Written assignments, lab instructions, demonstration summaries • Visual warning system for lab emergencies • Use of electronic mail for class and private discussions
Learning Disability	• Notetakers and / or audio-taped class sessions, captioned films • Extra exam time, alternative testing arrangements • Visual, aural, and tactile instructional demonstrations • Computer with voice output, spellchecker, and grammar checker
Mobility Impairment	• Notetaker / lab assistant; group lab assignments • Classrooms, labs, and field trips in accessible locations • Adjustable tables; lab equipment located within reach • Class assignments made available in electronic format • Computer equipped with special input device (e.g., voice input, Morse code, alternative keyboard)
Health Impairment	• Notetaker • Flexible attendance requirements and extra exam time • Assignments made available in electronic format; use of email to facilitate communication

Useful Teaching Techniques

Below you will find examples of teaching techniques in the classroom, laboratory, examinations, and field work that benefit all students, but are especially useful for students who have disabilities.

Classroom

- Select course materials early so that students and the campus Disabled Student Services office have enough time to translate them to audio-tape, Braille, and large print.
- Make syllabi, short assignment sheets, and reading lists available in electronic format (e.g., disk, electronic mail, WWW).
- Face the class when speaking. Repeat discussion questions.
- Write key phrases and lecture outlines on the blackboard or overhead projector.

Laboratory

- Take the student on a tour of the lab he/she will be working in. Discuss safety concerns.
- Assign group lab projects in which all students contribute according to their abilities.
- Arrange lab equipment so that it is easily accessible.
- Give oral and written lab instructions.

Examination and Fieldwork

- Assure that exams test the essential skills or knowledge needed for the course or field of study.
- Some students will require extra time to transcribe or process test questions; follow campus policies regarding extra time on examinations.
- Consider allowing students to turn in exams via electronic mail or diskette.
- Ask student how he/she might be able to do specific aspects of field work. Attempt to include student in field work opportunities, rather than automatically suggesting non-field work alternatives.
- Include special needs in requests for field trip vehicle reservations.

DO·IT

University of Washington
College of Engineering
Computing & Communications
College of Education

Videotape

A 9-minute videotape, *Working Together: Faculty and Students with Disabilities*, may be ordered by sending a $20 check to DO-IT.

About DO-IT

DO-IT (Disabilities, Opportunities, Internetworking and Technology) recruits students with disabilities into science, engineering, and mathematics programs, making extensive use of computers, adaptive technology, and electronic networking. This publication and the related materials and videotape were primarily funded by NEC Foundation of America, US WEST Communications, the National Science Foundation, and the State of Washington as part of DO-IT. For more information, to be placed on the DO-IT mailing list, or to request materials in an alternative format, contact:

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Campus Resources

DO·IT

Working Together: Faculty and Students with Disabilities

Meet the Speakers in the Videotape

Dr. Sheryl Burgstahler is an Assistant Director within Computing & Communications and a Research Assistant Professor in the College of Education at the University of Washington. She directs DO-IT (Disabilities, Opportunities, Internetworking, and Technology), a project to recruit students with disabilities into science, engineering, and mathematics academic programs and careers. She received bachelors and masters degrees in mathematics and a Ph.D. in Higher Education at the University of Washington. Her doctoral studies and research focus is on computers, adaptive technology, and the Internet network as empowering tools for individuals with disabilities.

Dr. Hellmut Golde is Professor Emeritus of Computer Science and Engineering at the University of Washington. He received his Ph.D. in Electrical Engineering from Stanford University and has taught Electrical Engineering and Computer Science at the University of Washington since 1960. Recently, he has become interested in the application of adaptive computer technology to students with disabilities and is an active participant in the University of Washington DO-IT project.

Kevin Berg has had Cerebral Palsy since birth. He attends Seattle Pacific University and is studying Computer Science. He lives on campus in a dorm; a fellow student is his personal assistant. His interests include multimedia, telecommunications, and computer games. Over the Internet network, Kevin communicates with many people, including his professors. He uses a head-stick and special software to enter double-key commands on his computer. Upon graduation, Kevin would like to be a computer programmer.

Karl Booksh is a graduate student and teaching assistant in Chemistry at the University of Washington, expecting to complete his Ph.D. soon. He is a member of the DO-IT Advisory Board and a mentor to high school students with disabilities who participate in the DO-IT program at the University of Washington. Karl received a graduate fellowship from the American Chemical Society's Division of Analytical Chemistry. Karl has no use of his legs and limited use of his hands as a result of a spinal chord injury. Upon graduation, Karl would like to teach at a small college.

Dr. Lesley B. Olswang is a Professor in the Department of Speech and Hearing Sciences at the University of Washington. She received her academic degrees at Northwestern University, the University of Illinois, and the University of Washington. Dr. Olswang is also certified as a Speech/Language Pathologist. Her interests have focused on children with communication disorders who function below the age of three. Her research interests include how children learn language and how intervention might alter the language learning process.

Dr. Gay Lloyd Pinder has been deaf for the past twelve years. She uses sign language interpreters to receive information that is presented orally and voices for herself. She uses a TDD for phone conversations. In her doctoral program she was introduced to electronic mail as an alternative for communicating with hearing professors who do not know sign language. Electronic mail allows her to communicate with more people than via TDD because it does not require specialized equipment. She recently completed a Ph.D. in Speech and Hearing Sciences at the University of Washington, with a primary focus on research. Gay Lloyd works as a communication therapist with infants and young children with communication problems that are secondary to their motor disabilities, helping them develop the foundation for communication so they will ultimately be able to use augmentative equipment.

Dr. Wendy (Pava) David has been blind since the age of eight when she experienced an allergic reaction to penicillin. She recently received her Ph.D. in Clinical Psychology from the University of Washington. She is employed at the American Lake Veterans Administration Medical Center, where she works primarily with Vietnam Veterans who suffer from post-traumatic stress disorder. Wendy uses computer systems with speech and Braille output to write notes and reports.

Dr. Mark T. Greenberg is a Professor of Psychology at the University of Washington. He received his B.A. degree from the Johns Hopkins University and his Ph.D. from the University of Virginia. His research interests concern the early development of family relationships, the prevention of violence and delinquency, and the social development of children who are deaf and hearing-impaired. He has published more than 100 scientific articles and books.

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Opening Doors: Mentoring on the Internet

DO-IT

Most of us can think of people in our lives, more experienced than ourselves, who have supplied information, offered advice, presented a challenge, initiated friendship, or simply expressed an interest in our development as a person. Without their intervention we may have remained on the same path, perhaps continuing a horizontal progression through our academic, career, or personal lives.

The term "mentor" has its origin in Homer's *Odyssey* when a man named Mentor was entrusted with the education of the son of Odysseus. "Protégé" refers to the person who is the focus of the mentor. Today, mentoring is associated with a variety of activities including teaching, counseling, sponsoring, role modeling, job shadowing, academic and career guidance, and networking.

DO-IT Mentors are valuable resources to their protégés in project DO-IT (Disabilities, Opportunities, Internetworking, and Technology). Most Mentors are college students, faculty, practicing engineers, scientists, or other professionals who have disabilities. Protégés are participants in the DO-IT Scholars, Pals, or Campers programs. These students are making plans for post-secondary education and employment. They all have disabilities including vision, hearing, mobility, and health impairments, and specific learning disabilities. Frequent electronic communications and personal contacts bring DO-IT protégés and mentors together to facilitate academic, career, and personal achievements.

Introducing protégés to mentors with similar disabilities is a strength of the DO-IT program. As reported by one protégé, she had never met an adult with a hearing impairment like hers before getting involved in DO-IT: "But when I met him, I was so surprised how he had such a normal life, and he had a family, and he worked with people who had normal hearing. So he made me feel a lot better about my future."

Participants learn strategies for success in academics and employment. Mentors provide direction and motivation, instill values, promote professionalism, and help protégés develop leadership skills. As one Scholar noted, "It feels so nice to know that there are adults with disabilities or who know a lot about disabilities, because I think that people who are about to go to college or start their adult life can learn a lot from mentors . . ." As participants move from high school to college and careers they too become mentors, sharing their experiences with younger participants.

There are probably as many mentoring styles as there are personality types and no one can be everything to one person. Each DO-IT participant benefits from contact with several mentors.

Most mentoring in DO-IT takes place via the Internet. Through electronic communications and projects using the Internet, mentors promote personal, academic, and career success. Electronic communication eliminates the challenges imposed by time, distance, and disability that are characteristic of in-person mentoring. For example, participants who have speech impairments or are deaf do not need special assistance to communicate via electronic mail. Those who cannot use the standard keyboard because of mobility impairments, use adaptive technology to operate their computer systems.

DO-IT encourages one-to-one communication between protégés and mentors via electronic mail. It also facilitates communication in small groups through the use of electronic discussion lists. For example, one group includes both mentors and protégés who are blind. They discuss common interests and concerns such as independent living, speech and Braille output

systems for computers, and options for displaying images and mathematical expressions.

While most communication occurs via electronic mail, some mentors meet their protégés during summer study programs at the University of Washington and at other DO-IT activities across the United States. In-person contact strengthens relationships formed on-line.

The DO-IT program received national recognition with The Presidential Award for Excellence in Mentoring "for embodying excellence in mentoring underrepresented students and encouraging their significant achievement in science, mathematics, and engineering." It was also showcased in the President's Summit on Volunteerism and received the National Information Infrastructure Award "for those whose achievements demonstrate what is possible when the powerful forces of human creativity and technologies are combined."

Research

DO-IT has conducted an extensive research study on the nature and value of electronic mentoring. More than 12,000 electronic mail messages were collected, coded, and analyzed; surveys were distributed to Scholars and Mentors; and focus groups were conducted.

Results of this study suggest that computer-mediated communication can be used to initiate and sustain both peer-peer and mentor-protégé relationships and alleviate barriers to traditional communications due to time and schedule

DO-IT Mentors offer Protégés . . .

Information – Mentors share their knowledge and experiences with protégés.

Contacts – Mentors introduce their protégés to valuable academic, career, and personal contacts.

Challenges – Mentors stimulate curiosity and build confidence by offering new ideas and opportunities.

Support – Mentors encourage growth and achievement by providing an open and supportive environment.

Direction – Mentors help protégés discover their talents and interests and devise strategies to attain their goals.

Advice – Mentors make suggestions to help protégés reach their academic, career, and personal goals.

Role Modeling – Mentors accomplish many of these goals by letting their protégés know who they are.

limitations, physical distances, and disabilities of participants. Both young people and mentors in the study actively communicate on the Internet and report positive experiences in using the Internet as a communication tool. The Internet gives these young people support from peers and adults otherwise difficult to reach, connects them to a rich collection of resources, and provides opportunities to learn and contribute. Participants note benefits over other types of communication, including the ability to communicate over great distances quickly, easily, conveniently, and inexpensively; the elimination of the barriers of distance and schedule; the ability to communicate with more than one person at one time; and the opportunity to meet people from all over the world. Many report the added value that people treat them equally because they are not immediately aware of their disabilities. Negative aspects include difficulties in clearly expressing ideas and feelings, high volumes of messages, occasional technical difficulties, and lack of in-person contact.

This study demonstrates that peer-peer and mentor-protégé relationships on the Internet perform similar functions in providing participants with psychosocial, academic, and career support. However, each type of relationship has its unique strengths. A higher percentage of correspondence between mentors and protégés than between peers involves communication about academics, careers, disabilities, technical issues, the DO-IT program, and college transition. Peer-to-peer communication includes more personal information than exchanges between mentors and protégés. Responses to the survey and focus group questions also reflect a stronger social attraction between peers. These results suggest that peer-to-peer communications relate more to the psychosocial domain, as peers devote energy to developing friendships, whereas mentor-protégé relationships emphasize information exchange related to academic, career, and other areas of a practical nature.

It is often reported in the literature that peer and mentor support can help students with disabilities reach their social, academic, and career potential. However, constraints imposed by

DO-IT Protégés offer Mentors . . .

Challenge – Mentors develop their own personal styles for sharing their skills and knowledge via electronic communication.

Opportunities to Help Set Goals – One Mentor explains, "I try to tell the DO-IT kids to listen to their hearts and think about what they really want to do. Don't listen to people who say no, you can't do this or that, or you should be thinking only about this kind of work; just think about what you really want to do, what turns you on, and go for it."

A Chance to Share Strategies – Mentors pass on hard-earned experiences. As reported by one Mentor, "I've been through this thing. I had a stroke and so on. And I find it incredibly gratifying to be able to share that with someone, and to be able to help someone else who's going through some of the same things."

New Ideas – Mentors join an active community of talented students and professionals with a wide range of disabilities who are eager to share their own strategies for problem-solving and success.

Fun – Mentors share in the lives of motivated young people. Listening to them, hearing about their dreams, helping them along the road to success – it's fun!

time, distance, and disability make such relationships difficult to initiate and sustain. This study suggests that practitioners and parents should consider using the Internet as a vehicle for developing and supporting positive peer and mentor relationships.
For more information about this study, contact the DO-IT office.

Getting Started

Following are a few suggestions for new DO-IT Mentors.

- Get to know each protégé. What are his/her personal interests? Academic interests? Career interests?

- Introduce yourself. Share your personal interests, hobbies, academic interests, career path.

- Explore interests with protégés by asking questions, promoting discussion, pointing to Internet and other resources.

- Encourage participation in DO-IT activities and try to attend activities when possible. Mentor-protégé relationships are strengthened through face-to-face contact!

- Facilitate contact between students and people with shared interests or resources (e.g., professors, professionals, service providers, friends).

DO-IT Electronic Resources

To contact staff, request publications or ask questions about the program, send electronic mail to *doit@u.washington.edu*

To send a message to all DO-IT Mentors, Scholars, and Pals, send electronic mail to one of the following addresses:
mentors@u.washington.edu
doitkids@u.washington.edu
doitpals@u.washington.edu

DO-IT Mentors are automatically subscribed to the doitsem discussion list which covers issues pertaining to individuals with disabilities and their pursuit of science, mathematics, engineering, and technology academics and careers. To send a message to the group use the address *doitsem@u.washington.edu*

For information related to DO-IT, disabilities, adaptive technology, science, engineering, mathematics, and post-secondary education, access the DO-IT World Wide Web page at *http://www.washington.edu/doit/*

Videotape

A 14 -minute videotape, *Opening Doors: Mentoring on the Internet*, may be ordered by sending a check for $20.00 to DO-IT.

About DO-IT

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Opening Doors: Mentoring on the Internet

Meet the Speakers in the Videotape

Dr. Sheryl Burgstahler is an Assistant Director within Computing and Communications and an Adjunct Associate Professor at the University of Washington. She directs DO-IT (Disabilities, Opportunities, Internetworking, and Technology). DO-IT recruits students with disabilities into challenging fields such as science, engineering, and mathematics academic programs and careers. Dr. Burgstahler earned bachelors and masters degrees in mathematics and a Ph.D. in higher education at the University of Washington. Her doctoral studies and research focus on technology as an empowering tool for individuals with disabilities.
sherylb@cac.washington.edu

James O'Connor grew up in California, the youngest of four kids. Throughout his life James has struggled with Dyslexia. However, he recently received a bachelors degree in Education from Central Washington University. He teaches at Juanita High School in Kirkland, Washington and works part-time for DO-IT as a Counselor / Coordinator.
oconnorj@u.washington.edu

Kevin Berg has had Cerebral Palsy since birth. He graduated from Seattle Pacific University with a degree in Computer Science. His interests include multimedia, telecommunications, and computer games. Kevin is a computer consultant. Over the Internet Kevin communicates with people and accesses information using a head-wand and special software for entering multiple-key commands.
kberg@lenacres.org

C. J. Bowman is from Washington state. He has Attention Deficit Disorder (ADD) and some learning disabilities in English and spelling. He enjoys math, astronomy, playing his guitar, exploring music on the computer, bicycle riding, swimming, and roller skating. He loves to work on computers. Internet access gives him the tools to explore his academic and career interests in computer music and the sciences.
cjb@u.washington.edu

Bridget McCarthy is a sophomore at Whitman College in Washington State, pursuing a career in pediatric audiology. She has a hearing impairment. Her interests include genetics, medicine, chemistry, evolution, swimming, traveling, and working with animals. DO-IT helped her prepare for college and deal effectively with disability related issues. At DO-IT's summer program and through her electronic mentoring experience she has met many people and learned important lessons to ensure her success in college. *bridgetm@u.washington.edu*

Dr. Roger Harris is an Associate Professor of Neuroanatomy at the University of Washington School of Medicine. He is also a stroke survivor, due to a severe intracerebral hemmorhage he suffered 11 years ago. He walks with a quad cane, has some short term memory loss, and is on dialysis due to kidney failure. He can't use his left hand and considers himself a "unidexter." Dr. Harris has written about his experiences in a book titled "Life at a Snail's Pace." He has been a Mentor with DO-IT for five years and loves the opportunity to use his experiences to help kids who are just going through it. "DO-IT is a wonderful program!"

Karen Braitmayer has a mobility impairment. She is an architect in Seattle and finds her mentoring experience with young people in DO-IT challenging and stimulating. *stupack@aol.com*

Ed Pottharst is an environmental planner at Seattle City Light. Deaf since birth, Ed enjoys the outdoors and environmental education. He finds mentoring to be a great way to meet and learn from other people. He has been a mentor for DO-IT since 1993. *edp@u.washington.edu*

Greg Smith has been a software engineer at Microsoft since 1994. He broke his neck playing football his sophomore year at Stanford University and, as a result, is a C5 quadriplegic. Greg is a mentor at DO-IT working with students online during the year and in person during DO-IT summer study programs. *gregsmi@microsoft.com*

About DO-IT

This material is based upon work supported by the National Science Foundation under Grant No. 9725110, which was provided as part of DO-IT's Presidential Award for Excellence in Science, Mathematics, and Engineering Mentoring. Any questions, findings, and conclusions or reccomendations expressed in this material are those of the author and do not necessarily reflect the views of the National Science Foundation. For more information, to be placed on the mailing list, or to request materials in alternative format, contact:

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Equal Access: Computer Labs

DO·IT

As increasing numbers of people with disabilities pursue educational opportunities that require computer use, accessibility of computing facilities becomes even more critical. The key is simply equal access. Everyone who needs to use your lab should be able to do so comfortably.

To make your lab accessible, employ principles of universal design. Universal design means that, rather than design your facility for the average user, you design it for people with a broad range of abilities. Keep in mind that individuals using your lab may have learning disabilities or visual, speech, hearing, and mobility impairments.

As you plan services in your computing facility, consider all of your potential users, including those with disabilities. Make sure visitors can:

- get to the facility and maneuver within it.
- access materials and electronic resources.
- make use of equipment and software.

Also make sure that staff are trained to support people with disabilities and have a plan in place to respond to specific requests in a timely manner. With these key issues in mind, you can make your lab accessible to everyone.

The following general access questions can help guide you in making your facility universally accessible.

Building Access

__ Are parking areas, pathways, and entrances to the building wheelchair-accessible?
__ Are doorway openings at least 32 inches wide and doorway thresholds no higher than 1/2 inch?
__ Are ramps and/or elevators provided as alternatives to stairs?
__ Are elevator controls accessible from a sitting position?
__ Do the elevators have both auditory and visual signals for floors? Are elevator controls marked in large print and Braille or raised notation?
__ Have protruding objects been removed or minimized for the safety of users who are visually impaired?
__ Are wheelchair-accessible restrooms near the lab marked with high visibility signs?
__ Are there ample high-contrast, large print directional signs to the lab?
__ Are telecommunication devices for the deaf (TTYs) available?

Lab Staff

__ Are staff members familiar with the adaptive technology and alternative document formats available in the lab?
__ Are staff members aware of disability issues? (See Helpful Communication Hints)

Physical Space and Printed Materials

__ Are large print, high-contrast signs used in the lab?
__ Are computers labeled as accessible in large print and Braille?
__ Are aisles kept wide and clear for wheelchair users?
__ Is at least one table for each type of workstation adjustable so that a person in a wheelchair, or a person of short stature can achieve a comfortable position? Can the adjustment controls be reached by wheelchair users?
__ Are document holders available to help position documentation so that it can be easily read?
__ Is all documentation available (or available in a timely manner) in alternative formats such as Braille, large text, audio, and electronic text? Are printed materials within easy reach from a variety of heights without furniture blocking access? Is a CCTV or large magnifying glass available to enlarge printed materials?
__ Are hearing protectors available for users who are distracted by noise in the facility?

Computers and Software

_ Do some keyboards have large print key labels, Braille labels, or home-row key indicators to help users with visual impairments locate keys?

_ Is screen enlargement software available for users with low vision? Are large monitors available so that a larger amount of screen can be viewed while magnified?

_ Is speech screen output available for visually impaired and learning disabled users? Are headphones and volume adjustment available?

_ Are mouse alternatives such as trackballs, keyboard control of the mouse, or other pointing devices available for those who have difficulty controlling a mouse?

_ Are keyboard guards available to assist users with impairments that limit fine motor control?

_ Are wrist rests available for those who require extra wrist support while typing?

_ Is equipment marked with large print and Braille labels?

_ Is software available to modify keyboard response such as sticky keys, repeat rate, and keystroke delay?

_ Are alternative keyboards such as a mini-keyboards or extended keyboards available for users with mobility impairments?

_ Are alternatives to keyboards such as a head pointing system, switch based interface, or voice dictation software available for users who cannot use keyboards?

_ Is word prediction software available to reduce the number of keystrokes needed for text entry?

_ Are one handed keyboards or "keyboard layout" software available?

_ Are audio warning signals available visually?

More information about adaptive technology can be found in the DO-IT videotape and brochure titled *Working Together: People with Disabilities and Computer Technology.*

Electronic Resources

_ Are text alternatives provided for graphic images?

_ Is standard HTML used for Web resources so that they can be accessed with a text-based browser?

_ Are electronic resources accessible to people using adaptive technology?

More information about universal design of electronic resources can be found in the DO-IT videotape and brochure titled *World Wide Access.*

First Steps

Although a lab cannot be expected to have specialized equipment for every type of disability on hand, staff should make equipment available that they can anticipate will be used and/or is available at relatively low cost. Provide:

- Printed resources that can be reached by a wheelchair user.
- An adjustable table for each type of workstation in your lab.
- Keyguard and wrist rest.
- Trackball, joystick, or other mouse alternative.
- Signs with high contrast and large print.
- Large print keytop labels, screen enlargement software, and a large monitor.
- Screen reading software and speech synthesizer.
- Key documents available in formats accessible to those who have low vision or who are blind.
- In key lab documents a statement about your commitment to access and procedures for requesting disability-related accommodations.
- Lab resources on the World Wide Web that employ principles of universal design.

Once a lab is established or has greater requirements consider adding:

- Scanner and Optical Character Recognition (OCR) software.
- CCTV.

- Braille printer and Braille translation software.
- Word prediction software.
- Alternative keyboards.
- Voice input software.

In addition, develop a procedure to assure a quick response to requests for adaptive technology that you do not currently have available.

Videotape

An 11-minute videotape, *Equal Access: Computer Labs*, demonstrates key points summarized in this handout. It may be ordered by sending a check for $20 to DO-IT.

Resources

DO-IT (Disabilities, Opportunities, Internetworking, and Technology)
http://www.washington.edu/doit/

EASI (Equal Access to Software and Information)
http://www.isc.rit.edu/~easi/

Trace Research and Development Center
http://www.trace.wisc.edu/

Closing The Gap
P.O. Box 68
Henderson, MN 56044
(612) 248-3294 (voice)
(612) 248-3810 (FAX)
CTGap@aol.com
http://www.closingthegap.com/

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Helpful Communication Hints

There are no strict rules when it comes to relating to people with disabilities. However, here are some helpful hints.

General

- Treat people with disabilities with the same respect and consideration that you do with others.
- Ask a person with a disability if he/she needs help before helping.
- Talk directly to the person with a disability, not through the person's companion.
- Refer to a person's disability only if it is relevant to the conversation.
- Avoid negative descriptions of a person's disability. For example, "a person who uses a wheelchair" is more appropriate than "A person confined to a wheelchair."
- Refer to the person first and then the disability. "A man who is blind" is better than "a blind man" because it emphasizes the person first.

Visual Impairments

- Be descriptive for people with visual impairments. Say, "The computer is about three feet to your left," rather than, "The computer is over there."
- When guiding people with visual impairments, offer them your arm rather than grabbing or pushing them.
- Always ask permission before you interact with a person's guide or service dog.

Learning Disabilities

- If asked, read instructions to users with a specific learning disability.

Mobility Impairments

- Try sitting or crouching to the approximate height of people in wheelchairs when you interact.

Speech Impairments

- Listen carefully and ask people with speech impairments to repeat what they have said if you don't understand.

Hearing Impairments

- Face people with hearing impairments and speak clearly when you talk to them so they can see your lips.

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Working Together: People with Disabilities and Computer Technology

DO·IT

People with disabilities meet barriers of all types. However, computers are helping to lower many of these bar-riers. As word processors have replaced typewriters, electronic spreadsheets have replaced handwritten books, and on-line services have supplemented telephone and written communication, disabled students and employees who have computer access have become capable of handling a wider range of activities independently. Although people with disabilities face a variety of barriers to providing computer input, interpreting output, and reading documentation, adaptive hardware and software have been developed to provide functional alternatives to standard operations.

Mobility Impairments

Input

Equipment which provides flexibility in the positioning of monitors, keyboards, documentation, and table tops is useful for many individuals with disabilities. Plugging all computer components into power outlet strips with accessible on/off switches makes it possible for some individuals to turn equipment on and off independently.

Some adaptive hardware and software assist individuals with little or no use of their hands in using a standard keyboard. Individuals who have use of one finger, a mouth- or head-stick, or some other pointing device, can control the computer by pressing keys with the pointing device. Software utilities can create "sticky keys" that electronically latch the SHIFT, CONTROL, and other keys to allow sequential keystrokes to input commands that normally require two or more keys to be pressed simultaneously. The key repeat function can be disabled for those who cannot release a key quickly enough to avoid multiple selections. Keyboard guards (solid templates with holes over each key to assist precise selection) can be used by those with limited fine motor control.

Sometimes repositioning the keyboard and monitor can enhance accessibility. For example, mounting keyboards perpendicular to tables or wheelchair trays and at head-height can assist individuals with limited mobility who use pointing devices to press keys. Other simple hardware modifications can assist individuals with mobility impairments. For example, disk guides can assist with inserting and removing diskettes; a dedicated hard disk and/or computer network access can eliminate or reduce the necessity to do so.

For individuals who need to operate the computer with one hand, left- and right-handed keyboards are available. They provide more efficient key arrangements than standard keyboards designed for two-handed users.

Some hardware modifications completely replace the keyboard and/or mouse for individuals who cannot operate these standard devices. Expanded keyboards (larger keys, spaced far apart) can replace standard keyboards for those with limited fine motor control. Mini-keyboards provide access to those who have fine motor control but lack a range of motion great enough to use a standard keyboard. Track balls and specialized input devices can replace mice.

For those with more severe mobility impairments keyboard emulation is available, including scanning and Morse code input. In each case, special switches make use of at least one muscle over which the individual has voluntary control (e.g., head, finger, knee, mouth). In scanning input, lights or cursors scan letters and symbols displayed on computer screens or external devices. To make selections, individuals use switches activated by movement of the head, finger, foot, breath, etc. Hundreds of switches tailor input devices to individual needs. In Morse code input, users input Morse code by activating switches (e.g., a sip-and-puff switch registers dot with a sip and dash with a puff). Special adaptive hardware and software translate Morse code into a form that computers understand so that standard software can be used.

Voice input provides another option for individuals with disabilities. Speech recognition systems allow users to control computers by speaking words and letters. A particular system is "trained" to recognize specific voices.

Special software can further aid those with mobility impairments. Abbreviation expansion (macro) and word prediction software can reduce input demands for commonly-used text and keyboard commands. For example, word prediction software anticipates entire words after several keystrokes and increases input speed.

Output
Individuals with mobility impairments who have difficulty obtaining output from printers may need assistance from others.

Documentation
On-screen help can provide efficient access to user guides for individuals who are unable to turn pages in books.

Blindness

Input
Most individuals who are blind use standard keyboards, however Braille input devices are available. Braille key labels assist with keyboard use.

Output
Voice output can be used to read screen text to blind computer users. Special software programs "read" computer screens and speech synthesizers "speak" the text. The availability of earphones for individuals using voice output systems can reduce the distractions for others nearby.

Refreshable Braille displays allow line-by-line translation of the screen into Braille on a display area where vertical pins move into Braille configurations as screen text is scanned. Braille displays can be read quickly by those with advanced Braille skills, are good for detailed editing (e.g., programming and final editing of papers), and do not disrupt others in work areas because they are quiet. Braille printers provide output for blind users.

Documentation
Scanners with optical character recognition can read printed material and store it electronically on computers, where it can be read using voice synthesis or printed using Braille translation software and Braille printers. Such systems provide independent access to journals, syllabi, and homework assignments for blind students. Some hardware and software vendors also provide Braille or ASCII versions of their documentation to support blind users.

Low Vision

Input
Most individuals who have visual impairments can use standard keyboards, but large print keytop labels are sometimes useful.

Output
Special equipment for individuals who are visually impaired can modify display or printer output. Computer-generated symbols, both text and graphics, can be enlarged on the monitor or printer, thereby allowing individuals with low vision to use standard word processing, spreadsheet, electronic mail, and other software applications. For individuals with some visual impairments, the ability to adjust the color of the monitor or change the foreground and background colors is also of value. For example, special software can reverse the screen from black on white to white on black for people who are light sensitive. Anti-glare screens can make screens easier to read. Voice output systems are also used by people with low vision.

Documentation
Scanners with optical character recognition can read printed material and store it electronically on computers, where it can be read using voice synthesis or printed in large print. Some hardware and software vendors also provide large print or ASCII versions of their documentation.

Hearing and/or Speech Impairments

Speech and hearing disorders alone do not generally interfere with computer use. However, advanced speech synthesizers are close enough to human quality to act as substitute voices and thus provide a compensatory tool for students who cannot communicate verbally. Students with portable systems can participate in class discussions once adapted computers provide them with intelligible speaking voices. Word processing and educational software may also help hearing impaired students develop writing skills.

Input
Students with hearing disabilities generally do not have special problems inputting information with a standard keyboard and mouse.

Output
Alternatives to audio output can assist the hearing-impaired computer user. For example, if the sound volume is turned to zero, a Macintosh computer will flash the menu bar when audio output is normally used.

Documentation
Individuals with hearing impairments typically do not have difficulty using standard written or on-screen documentation.

Specific Learning Disabilities

Educational software where the computer provides multi-sensory experiences, interaction, positive reinforcement, individualized instruction, and repetition can be useful in skill building. Some students with learning disabilities who have difficulty processing written information, can also benefit from completing writing assignments, tutorial lessons, and drill-and-practice work with the aid of computers. For example, a standard word processor can be a valuable tool for individuals with dysgraphia, an inability to produce handwriting reliably.

Input

Quiet work areas and ear protectors may make computer input easier for individuals with learning disabilities who are hyper-sensitive to background noise.

Software that aids in efficient and accurate input can also assist. Some people can compensate for high rates of input errors by using spell checkers, thesauruses, and grammar checkers. In addition, word prediction programs (software that predicts whole words from fragments) have been used successfully by students with learning disabilities. Similarly, macro software which expands abbreviations can reduce the necessity to memorize keyboard commands and can ease the entry of commonly-used text.

Output

Some learning disabled individuals find adaptive devices designed for those with visual impairments useful. In particular, large print displays, alternative colors on the computer screen, and voice output can compensate for some reading problems. People who have difficulty interpreting visual material can improve comprehension and the ability to identify and correct errors when words are spoken or printed in large fonts.

Documentation

Some individuals with learning disabilities find it difficult to read. Computer documentation provided in electronic forms can be used by enlarged character and voice synthesis devices to make it accessible to those with reading difficulties.

Next Steps

Continue your exploration of adaptive technology by:

- Buying the newspaper or directory and/or attending the conference of Closing the Gap, P.O. Box 68, Henderson, MN 56044; 612-248-3294, *http://www.closingthegap.com/*.
- Contacting the Tech Act resource center in your state; call RESNA at 703-524-6686, or visit *http://www.resna.org/resna/hometa1.html* for information.
- Joining electronic discussion lists and accessing resources on the Internet. A good place to start is the DO-IT home page at *http://www.washington.edu/doit/*.

Videotape

A 14-minute videotape, *Working Together: People with Disabilities and Computer Technology* may be ordered by sending a $20 check to DO-IT.

About DO-IT

DO-IT is primarily funded by the National Science Foundation, the U.S. Department of Education and the State of Washington. For more information, to be placed on the DO-IT mailing list, or to request materials in an alternative format, contact:

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DO-IT

University of Washington
College of Engineering
Computing & Communications
College of Education

Working Together: People with Disabilities and Computer Technology

Meet the Speakers in the Videotape

Eric
I am without vision and rely on hearing and touch. I use a personal computer with a speech synthesizer, scanner, Braille printer and, of course, a modem and access to the Internet. My interests are in biology, communications, radio, and other electronics.

Hollis
I have Cerebral Palsy and use a power wheelchair. I also have impaired speech. I control my computer with a joystick and a footswitch that I helped design. I also use Morse code to type text. My interests are in civil and mechanical engineering. My goal is to become a civil engineer.

Nhi
My vision is limited as the result of Multiple Sclerosis. I use large print and voice output programs on my computer. After I finish high school I will go to college to study computer science.

Sherri
I have optic atrophy and am legally blind. I use software that enlarges screen images so that I can see them. It has been invaluable to me to have a computer and Internet access. I have met many people and have learned about their college experiences which will help my transition to college. My interests are in genetics, psychology, and computers, and I enjoy doing volunteer work in my community.

Anna
I've been blind since I was four as a result of a kind of cancer called retinoblastoma. My major in college is cellular and molecular biology and I would like to go into genetics. My computer has been invaluable to me. It reads the screen to me. I could not write papers or do homework without it. Someday I would like to be a working member of the crew on the space shuttle.

Randy
I am totally blind. My interests include foreign languages and computer science. My computer and Internet account opened a whole new world for me and have given me independecne.

Lloyd
I have a hearing impairment My computer gives visual cues instead of aural. I am interested in electrical engineering.

Katie
I have a hearing impairment. I use computers for school and work. I have met lots of interesting people on the Internet.

Takuya
My disabilities are health impairment, nervous system dysmorphia, and congenital scoliosis. My interests are physics, biology, theory of math, trigonometry, calculus, and computers. The Internet has helped me find information about college.

Daniel
I have a learning disabililty. I have trouble in math and spelling. It takes me longer to read and take tests. Computers help me with spelling and grammar and make my reports look more professional.

Sarah
I have a learning disability called Dyslexia which affects my reading, math, and spelling. Computers help me with these subjects and have made me open more doors for myself in believing I can DO-IT for life! After high school I plan on going to a university in Nevada and majoring in Clinical Lab Science.

Katharine
I'm learning disabled and reading is difficult. I enjoy mathematics, business, and engineering. I use voice output and a scanner with my computer, both of which help me with reading. I have met really great, supportive people through e-mail.

Mitch
My primary disability is Spina Bifida. It is minor, but the secondary condition, Scoliosis, has caused me to be in the hospital a lot. My greatest scientific interest is genetics. On the Internet I have access to a whole world of people and information.

Rodney
My disability is Arthrogryposis Multiplex Congenita (AMC). I have no functional use of my arms and legs. I use a mouth stick to operate my computer. My interests include computer programming, reading, writing, and wasting time. I plan to go to college and study political science and journalism.

Erofei
I lost my hands in a farming accident. After I graduate from high school, I plan to attend college and become a drafting engineer. Some of my favorite activities are soccer, fishing, and rollerblading.

Mark
I have Muscular Dystrophy and use a wheelchair. I use adaptive technology that allows me to operate the computer and the Internet using my head. My interests are astronomy, art, and writing.

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Ben
I have Muscular Dystrophy. Since getting access to the Internet, my subjects of interest have increased dramatically because now I can access information on a whim. Without my computer and the Internet, I'd still probably be watching other people have success but now they're watching me.

Maria
I have post-polio which makes it difficult to walk. I'm interested in psychology, biology, and chemistry. Having a computer connected to the Internet helps me out with all of my classes. Instead of walking to the library, I can have a head start finding crucial information to write a paper for my classes.

Nadira
I have neuropathy and I use a wheelchair. After high school I plan to go to medical school. My interests are computers, music, and reading.

Megan
My disability is chronic lyme disease. The computer enables me to do schoolwork from home. My academic interests are biology, anatomy, physiology, and math. I am also interested in music.

About DO-IT

DO-IT (Disabilities, Opportunities, Internetworking, and Technology) is primarily funded by the National Science Foundation, the U.S. Department of Education, and the State of Washington. This handout and accompanying videotape are based upon work supported by the National Science Foundation under Grant No. 9255803. Any questions, findings, and conclusions or recommendations expressed in this material are those of the author and do not necessarily reflect the views of the National Science Foundation. For more information, to be placed on the DO-IT mailing list, or to request materials in an alternative format, contact:

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DO·IT

Working Together: Science Teachers and Students with Disabilities

Disabilities
Opportunities
Internetworking
Technology

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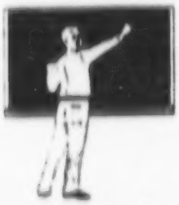
Working Together: Science Teachers and Students with Disabilities

As scientific fields make increasing use of technology, new opportunities emerge for people with a variety of abilities. When students with disabilities and science teachers form learning partnerships, the possibilities for academic and career success multiply.

Some students with disabilities have conditions that are invisible; some are visible. Since each person's situation is unique, the best solutions for maximizing participation come about when the student and teacher work together to develop creative alternatives for challenges faced by students with disabilities. Such challenges include gaining knowledge and demonstrating knowledge. In most cases, it takes just a little creativity, patience, and common sense to make it possible for everyone to learn and contribute.



Gaining Knowledge

Many students with disabilities face challenges to gaining knowledge. Examples of specific challenges and accommodations follow.

The student who has difficulty...	can be accommodated by...
...reading standard text or graphics due to visual impairment	...materials in large print or Braille, on tape, or via computer; enlarged or tactile drawings; access to adaptive technology that provides enlarged, voice, and/or Braille output.
...seeing materials on blackboard or overhead projector due to visual impairment	...binoculars; verbalization of the content and oral descriptions of all visually displayed materials.
...reading output from standard equipment because of visual impairment	...interfacing lab equipment with computer and providing large print and/or speech output; scientific equipment with Braille and large print markings.
...hearing presentations and instructions	...FM system; interpreter; printed materials; facing student for lip reading; overhead projector or blackboard.
...hearing multimedia and videotaped presentations	...captioned presentations; interpreter.
...participating in class discussions due to hearing or speech impairment	...electronic communications (e.g., Internet) where the ability to hear or speak is not required; portable computer with speech output.

...understanding concepts due to a specific learning disability	...visual, aural, and tactile demonstrations incorporated into instruction.
...reading because of a specific learning disability	...extra time and access to materials via a computer equipped with speech and large print output and Internet access.
...taking notes in class because of mobility or visual impairment	...in-class access to a computer with adaptive technology and a word processor.
...operating lab equipment and conducting lab experiments due to mobility impairment	...accessible facility; adjustable-height tables; lab partner; scribe; computer-controlled lab equipment with alternative input devices (e.g., speech, Morse code, alternative keyboard); modified scientific equipment.
...seeing demonstrations while seated in a wheelchair; viewing lab experiments	...adjustable height tables and flexible seating arrangements.
...completing an assignment or lab because of a health impairment	...flexible scheduling arrangements.
...doing research	...information accessible on computer (disk, Internet) with adaptive technology.

Demonstrating Knowledge

Some students with disabilities cannot demonstrate mastery of a subject by writing, speaking, or by working through a problem in a lab. Many of the accommodations for gaining knowledge can help the student demonstrate mastery of a subject as well. Examples of other accommodations follow.

The student who has difficulty...	can be accommodated by...
...completing and submitting worksheets and tests because of visual impairment and/or specific learning disability	...worksheets and tests in large print or Braille, on tape, or via computer; access to adaptive technology that provides enlarged, voice and/or Braille as well as standard print output.
...completing a test or assignment because of a disability that affects the speed at which it can be completed	...extra time or alternative testing arrangements.
...completing a test or assignment because of the inability to write	...in-class access to a computer with alternative input (e.g., Morse code, speech, alternative keyboard) devices.

Electronic Resources

- To contact staff, request electronic copies of DO-IT NEWS, request publications or ask questions about the program, send electronic mail to *doit@u.washington.edu*
- To send a message to all DO-IT Scholars, DO-IT Pals or all Mentors, send electronic mail to one of the following addresses:
  doitkids@u.washington.edu
  doitpals@u.washington.edu
  mentors@u.washington.edu
- To discuss issues pertaining to individuals with disabilities and their pursuit of science, engineering, and mathematics (sem) academic programs and careers, subscribe to the doitsem LISTPROC discussion list by sending electronic mail to *listproc@u.washington.edu*.
  In the message text type "subscribe doitsem" followed by your name.
- For information resources related to DO-IT, disabilities, adaptive technology, science, engineering, mathematics, and post-secondary education, access the DO-IT World Wide Web pages at *http://weber.u.washington.edu/~doit*

Videotape

A 13-minute videotape, *Working Together: Science Teachers and Students With Disabilities*, may be ordered by sending a $20 check to DO-IT.

About DO-IT

DO-IT (Disabilities, Opportunities, Internetworking, and Technology) serves to increase the successful participation of individuals with disabilities in challenging academic programs such as those in science, engineering, mathematics and technology. Primary funding for the DO-IT program is provided by the National Science Foundation and the State of Washington. Additional grants have been received from Mitsubishi Electric America Foundation, NEC Foundation of America, the Seattle Foundation, the Telecommunications Funding Partnership, U.S. Department of Education (including the Fund for the Improvement of Postsecondary Education), US WEST Communications, Visio Corporation, The Washington State Office of Superintendent of Public Instruction, and an NSF Award for Mentoring. The University of Washington also contributes substantial resources to this project.

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Working Together: Science Teachers and Students with Disabilities

Meet the Speakers in the Videotape

Maria
I have post-polio which makes it difficult for me to walk. I keep one set of books at home and the other in my classes. It is important for teachers to be flexible in their schedules.

Matt
I have dyslexia. To aid students with learning disabilities, I think teachers should allow extra time for tests and schoolwork.

Anna
I am blind. I use a computer with voice output. In order to help students with visual impairments, professors should describe visual aids they present and provide tactile drawings.

Katie
I have a hearing impairment. What helps me in class is to have written instructions, both on handouts and on the blackboard.

Mike
My disabilities are attention deficit hyperactivity disorder and specific learning disability. My computer has spell and grammar checking which help when I write papers. I also ask professors for extra time for homework and tests.

Kris
I am visually impaired. I require large print handouts and tests. I also tell the teachers about my disability so they are prepared for any special requests from me.

Nhi
My vision is limited as the result of Multiple Sclerosis. I use large print and voice output programs on my computer. In class I use a magnifier for reading and binoculars to read the blackboard.

Shawnna
I have Muscular Dystrophy. I can't use my hands to write, so I use a computer for schoolwork. I also require large print handouts and use enlarged print on the computer screen.

Eric
I am without any vision. I rely on computers for schoolwork, and use voice output programs and Braille printers. I also use the Internet to research subjects.

Kristin
I am hard of hearing and partly blind. In class, I require large print handouts and an interpreter. I also use enlarged print on the computer screen.

Lloyd
I have a hearing impairment. It helps me to use interpreters and FM systems in my classes.

Rachel
I am partially paralyzed on the right side of my body as a result of a stroke. My memory was affected too. In class I need visual aids. It helps to be able to see things as well as listen to lectures.

Rodney
My disability is Arthrogryposis Mutiplex Congenita. I can't use my hands to write, so I require copies of notes, a notetaker, or a computer. I use a computer and the Internet to complete assignments and research.

Katherine
I have a learning disability and reading is difficult. I use a voice output program on my computer. In class, extra time is essential for tests and assignments.

Nguyen
I suffered a gunshot wound which paralyzed the left side of my body. I use a computer and the Internet to research projects. It's important to include every student in activities, no matter what their abilities.

Mark
I have Muscular Dystrophy and use a wheelchair. I rely on a computer to complete homework assignments and use a Morse Code input device since I can't use my hands.

Randy
I am totally blind. It helps me in class to receive my homework assignments over electronic mail and to have labs that don't require vision; I can't check for color changes.

Jenny
I have Peripheral Neuropathy. I require adjustable tables and lab equipment. I also use a computer to complete assignments and to research subjects on the Internet.

Travis
My disabilities include shortness, orthopedic problems, and kidney problems. The only accommodations I require in class are adjustable equipment and shorter aprons.

Megan
My disability is chronic lyme disease. I use a computer to work from home, and require flexibility in scheduling classes and tests.

Nadira
I have nueropathy. I require adjustable equipment in labs. It is important for professors to encourage students with disabilities to participate in science.

Erofei
I am an amputee. I think professors should assign partners in labs, so if there is something one person cannot do, they can still watch while their partner does it.

About DO-IT

DO-IT (Disabilities, Opportunities, Internetworking, and Technology) serves to increase the successful participation of individuals with disabilities in challenging academic programs such as those in science, engineering, mathematics and technology. The creation and distribution of this handout and videotape were made possible by the National Science Foundation under Grant Nos. 9255803 and 9550003. Any questions, findings, and conclusions or recommendations expressed in this material are those of the author and do not necessarily reflect the views of the National Science Foundation. For more information, to be placed on the mailing list, or to request materials in alternative format, contact:

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World Wide Access: Accessible Web Design

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The World Wide Web has rapidly become the dominant Internet tool, combining hypertext and multimedia to provide a network of educational, governmental, and commercial resources. The Web has mushroomed in popularity because it is such a powerful and versatile medium. Much of its power comes from the fact that it presents information in a variety of formats while it also organizes that information through hypertext links.

Because of the multimedia nature of the Web combined with the poor design of some Web sites, many Internet surfers cannot use the full range of resources this revolutionary tool provides. Some visitors:

- cannot see graphics because of visual impairments.
- cannot hear audio because of hearing impairments.
- use slow connections and modems or older equipment that cannot download large files.
- have difficulty navigating sites that are poorly organized with unclear directions because they have learning disabilities, speak English as a second language, or are younger than the average user.

Some people use adaptive technology with their computer to access the Web. For example, a person who is blind may use a speech output system to read aloud text that is presented on the screen; this system may be composed of screen reading software and a voice synthesizer. A person with a mobility impairment may not be able to use a mouse and rely on the keyboard for Web browsing. To create resources that can be used by the widest spectrum of potential visitors rather than an idealized "average," Web page designers should apply "universal design" principles. They should consider the special needs of individuals with disabilities, older persons, people for whom English is a second language, and those using outdated hardware and software.

Universal design techniques can be applied in the design of packaging, software, appliances, transportation systems and many other products and services. Examples of universal design in architecture are the inclusion of ramps and automatic door openers as well as Braille labels on elevator control buttons. Following universal design principles in creating a Web resource ensures that all Internet users can get to the information at a Web site regardless of their abilities, their disabilities, or the limitations of their equipment and software.

The Americans with Disabilities Act (ADA) of 1990 requires that U.S. programs and services be accessible to individuals with disabilities. A 1996 Department of Justice ruling makes it clear that ADA accessibility requirements apply to Internet resources.

The World Wide Web Consortium (W3C) develops the common protocols used on the Web to insure interoperability to promote universal access. As Tim Berners-Lee, Director of the W3C puts it:

> "The power of the Web is in its universality. Access by everyone regardless of disability is an essential aspect."

The W3C's Web Accessibility Initiative (WAI) has proposed guidelines for all Web authors. The following suggestions are based on the WAI guidelines for Web content. Follow these guidelines when developing and revising your Web pages to ensure that they are accessible to a diverse audience.

General Page Design

Designing a well-organized Web site helps visitors navigate through the information presented.

- **Maintain a simple, consistent page layout throughout your site.**
  A consistent design and look makes it easier for visitors to locate the specific information they seek. For example, a feature presented on every page, such as a standard navigation menu or logo for the site, should always appear in the same place. A carefully planned organizational scheme will help everyone use your site. A clear, consistent presentation will especially assist people with visual impairments or learning disabilities who have difficulty following disorganized presentations.

- **Keep backgrounds simple. Make sure there is enough contrast.**
  People with low vision or colorblindness, or those using black and white monitors, can have difficulty reading information at sites with busy backgrounds and dark colors. Some background images and colors obscure text and make reading difficult. Make sure that there is enough contrast between your text and the background of the page. Choose background, text and link colors carefully, and always test your site by viewing it at different resolutions and color depths. For example, you can change your

monitor settings to a resolution of 640x480 and 16 colors for one test, and change to 1024x768 and 24 bit color for another.

- **Use standard HTML.**
  Hypertext Markup Language (HTML) is the standard code used to create Web sites. HTML was designed to be a universal format outside the bounds of proprietary software and computer operating systems. The code works via tags that tell a Web browser where to find and how to display information. While nonstandard tags exist, using standard HTML as defined by the W3C will ensure that your content can be accessed by all browsers used by visitors to your site. Avoid tags, features and plug-ins that are available to only one brand or version of a browser.

- **Design large buttons.**
  Small buttons marking links can be difficult targets for visitors with mobility impairments that result in restricted hand movements. Larger buttons can make it easier for all visitors to select the links on your page. Test how your buttons appear and operate with a variety of monitor sizes and at different screen resolutions.

- **Caption video and transcribe other audio.**
  Multimedia formats that include audio can present barriers to people with hearing impairments as well as to people with less sophisticated computer systems. Provide captions and transcriptions for these resources so visitors who cannot hear have an alternative method for accessing the information.

- **Make links descriptive so that they are understood out of context.**
  Visitors who use screen reading software can adjust their software to read only the links on a page. For this reason, links should provide enough information when read out of context. Use a more descriptive phrase than "click here" as a link or next to a graphic used as a link. For example:

  ```
  <A HREF="./about.htm">Click here</A>
  for information about our company.
  ```

  will present "Click here" as the link. However,

  ```
  <A HREF="./about.htm">Information
  about our company.</A>
  ```

  will display "Information about our company." as the link text.

- **Include a note about accessibility.**
  Notify site visitors that you are concerned about accessibility by including a Web access symbol on your page (see Resources list). Include a statement about accessibility and encourage them to notify you with their accessibility concerns. For example, the DO-IT home page includes the following statement:

  > The DO-IT pages form a living document and are regularly updated. We strive to make them universally accessible. You will notice that we minimize the use of graphics and photos, and provide descriptions of them when they are included. Video clips are open-captioned, providing access to users who can't hear the audio. Suggestions for increasing the accessibility of these pages are welcome.

Graphical Features

People who are blind cannot view the graphical features of your Web site. Many people with visual impairments use voice output programs with nonstandard browsers (such as pwWebSpeak or Lynx) or graphical browsers with the feature that loads images turned off. Include text alternatives to make the content in graphical features accessible. Described below are guidelines for providing alternative text for various types of visual features.

- **Include appropriate ALT/LONGDESC attributes for graphical elements on your page.**
  ALT attributes work with HTML image tags to give alternative text descriptive information for graphical elements of a Web page. The alternative text helps visitors understand what is on the page if they are not viewing the graphic. This could be because they are blind and using a text-based browser or a graphical browser with the image loading feature turned off. The bold text in the following example shows what an ALT attribute looks like in HTML:

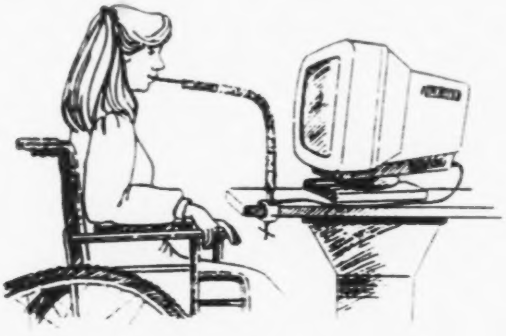
  ```
  <IMG SRC="./doitlogo.large.gif"
  ALIGN=MIDDLE ALT="[DO-IT LOGO]">
  ```

  When a sighted visitor views the page with a graphical browser, he will see a picture of the DO-IT logo. When someone who is blind visits, his voice output program will read **[DO-IT LOGO]**. This gives him a clear idea of what is on the page. In addition, any visitor coming to the site using a text-based browse will understand that there is a DO-IT logo there instead of the more ambiguous "image," the default result when no ALT attribute is used. ALT attributes should be short (less than 5 words) as browsers sometimes have difficulty displaying lengthy ALT text.

When using text to describe complex graphs or charts, or to transcribe sound files containing speech or lyrics, summarize the information next to the element, or consider using the LONGDESC attribute which provides for more detailed text than ALT. Lengthy descriptions can also be linked to an external document or immediately follow the graphic or sound element.

- **Include menu alternatives for image maps to ensure that the embedded links are accessible.**
  In an image map (also called ISMAP) a part of a picture can be clicked to activate a link to another page. For example, on a map of the United States, a visitor might click on an image of the state of Oregon to find information about the state. If the Web page developer has not included an alternative menu, visitors using text-based browsers can be totally blocked from the site, or sent on a wild goose chase clicking unlabeled links. The following example does not include an alternative menu for the image map.

```
<HTML>
<TITLE>Our Library Page</TITLE>
<BODY>
<A HREF="home.map">
<IMG SRC="images/home.jpg"ismap </A>
</BODY>
</HTML>
```



When viewed through a graphical browser, such as Netscape Navigator™ or Internet Explorer™, a beautiful picture of a floor map of a library appears. The visitor can choose selected areas of the library to view. But, when a visitor using a text-based browser visits the site, this is what he sees:

```
Our Library Page
[ISMAP]
```

At this point the visitor is stuck, as text-based browsers will not interpret the hypertext links embedded in the image map. His only option is to back out of the site. A visitor who uses a text-based browser, perhaps because he is blind, can't get to your information unless an alternative is provided. The accessibility of an image map depends on the software used as a Web site's server. Check with your system administrator to find out about the capabilities of your Web server software. Some server software will automatically render text links for image maps while other versions won't. Providing text alternatives to image-based links will ensure image maps are usable to the widest audience.

- **Include descriptive captions for pictures and transcriptions of manuscript images.**

  Providing ALT text for an image is sufficient for logos and graphics that contain little information content. However, if the graphics provide more extensive information, adding captions and transcriptions is important for those who cannot see your page because they are using a text-based browser or they have turned off the graphics loading feature of their browser. This includes people who are blind. If you are not sure how critical a particular image is to the content of a page, temporarily remove it and consider the impact of its loss.

  If you present information in an image format, such as a scanned-in image of a page of a manuscript, be sure to also provide a transcription of the manuscript in a straight text format. This alternative is useful for many visitors, including those with visual impairments and those with learning disabilities who may have difficulty reading the original document.

- **Use a NULL value for unimportant graphics.** Some graphical elements may add no content to a page and can be bypassed from viewing by using an ALT attribute with no text. By using just two quotation marks with no content, you can reduce the amount of distracting text when a page is viewed with graphics capabilities turned off or with a text-based browser. For example, the HTML for a divider bar could be:

```
<IMG SRC="./purplebar.gif"
ALIGN=MIDDLE ALT="">
```

Sighted visitors will see the divider bar, while those visiting via a text browser will see/hear nothing.

- **Provide audio description and transcripts of video.**
  If your multimedia resources provided on your site include video, people who cannot see will be unable to use this information unless it is provided in an alternative format. A text transcription provided with the video will give a visitor who cannot see, or who doesn't have the appropriate viewing software, access to the information in your video clip.

- **Consider other options for making graphical features accessible.**
  Some Web designers make an image accessible by placing a hyperlink "D" (for description) immediately before or after an image that links to another page with an image description. At the end of each description another hyperlink returns the user to the original page. This method should be used with caution as it can add unnecessary navigational complexity to the site.

  Some organizations with graphic-intensive Web pages provide a separate text version of their site to ensure accessibility. This adds a great deal of maintenance time and complexity as two versions of a site must be updated. It also segregates site visitors according to the type of equipment they use to access the Web. As much as possible, design a single version of your site so that it is accessible to all visitors.

Special Features

- **Use tables and frames sparingly and consider alternatives.**
  Most screen reader programs read from left to right, jumbling the meaning of information in tables. Some blind visitors can interpret tabular information, but it is best to look for other ways to present the information to ensure that visitors with visual impairments can reach your data. In the same vein, frames often present logistical nightmares to text-based screen reading software and make it difficult for visitors to share URLs of pages that may be buried within a frame structure. Evaluate whether frames are truly necessary at your site. If no alternatives to frames are available, ensure that frames are labeled with the TITLE attribute; provide a text alternative with NOFRAMES; and use the TARGET = "_top" attribute to ensure useful Uniform Resource Location (URL) addressing is provided for each interior frame.

- **Provide alternatives for forms and databases.**
  Some combinations of browsers and screen readers encounter errors with nonstandard or complex forms. Always test forms and databases with a text-based browser. Include an e-mail address and other contact information for those who cannot use your forms or database.

- **Provide alternatives for content in applets and plug-ins.**
  As future versions of software develop, applets (such as programs created with JavaScript™) and plug-ins (such as Adobe Acrobat™) may provide accessibility features. However, many of these programs are currently not accessible to people using text-based browsers. To ensure that people with visual and hearing impairments can access your information, provide the content from these programs in alternative, text-based formats. When using JavaScript, make sure to employ the built-in accessibility features within the Java Developer's Kit.

Web Pages Test

Test your Web site with a variety of Web browsers, and always test your pages with at least one text-based browser. This way you will see your Web resources from the many perspectives of your users. Also view the resources at your site using a variety of computer platforms, monitor sizes, and screen resolutions. Make use of an accessibility validation site that performs usability diagnostics on your pages and points out elements that could be inaccessible. Testing your site is especially important if you use HTML authoring software to write your pages as many of these programs do not automatically include ALT attributes and other accessibility features. Revise your HTML to make your site accessible.

Resources

Bobby, created at CAST (Center for Applied Special Technology), is an HTML validation program designed to test accessibility and highlight nonstandard and incorrect HTML.
http://www.cast.org/bobby/

DO-IT (Disabilities, Opportunities, Internetworking and Technology) hosts a rich collection of resources, including links to Internet resources for accessible Web design.
http://www.washington.edu/doit/

EASI's (Equal Access to Software and Information) Web site provides information related to serving patrons with disabilities including accessible Web design.
http://www.isc.rit.edu/~easi/

The National Center for Accessible Media (NCAM) promotes the use of a Web Access symbol and provides examples of accessible pages. NCAM also contains valuable resources on providing captions to streamed video resources.
http://www.wgbh.org/wgbh/pages/ncam/webaccess/index.html

A-Prompt, developed by the University of Toronto and The Trace Research and Development Center, is a tool for Web authors that works with existing HTML editors.
http://aprompt.snow.utoronto.ca/

Java accessibility resources are discussed at Sun Microsystems' Enabling Technologies Program.
http://www.sun.com/access

The Trace Research and Development Center provides resources for the design of accessible Web pages including applet and plug-in features.
http://www.trace.wisc.edu/

W3C's Web Accessibility Initiative outlines the strategies and tools for creating web sites that are highly usable.
http://www.w3.org/WAI/

World Wide Access Videotape

An 11-minute videotape, *World Wide Access*, introduces accessible Web design and may be purchased by sending $20 to DO-IT. This videotape is open captioned and an audio-described version can be requested.

About DO-IT

DO-IT (Disabilities, Opportunities, Internetworking, and Technology) serves to increase the successful participation of individuals with disabilities in challenging academic programs such as those in science, engineering, mathematics, and technology. Primary funding for the DO-IT program is provided by the National Science Foundation, the State of Washington, and U.S. Department of Education. Additional grants have been received from the AOL Foundation, the Jeld-Wen Foundation, Microsoft, Mitsubishi Electric America Foundation, NEC Foundation of America, the Samuel S. Johnson Foundation, the Seattle Foundation, the Telecommunications Funding Partnership, US WEST Communications, Visio Corporation, and the Washington State Office of Superintendent of Public Instruction. For more information, to be placed on the DO-IT mailing list, or to request materials in an alternative format, contact:

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The Winning Equation: Access + Attitude = Success in Math and Science

DO·IT

The Americans with Disabilities Act of 1990 and other federal and state legislation require that schools make programs accessible to students with disabilities. People with disabilities are underrepresented in many challenging careers, including those in science, mathematics, technology, and engineering. U.S. Census data show that persons with disabilities constitute more than 10 percent of the general work force and only 2 percent of the scientific and engineering work force. Negative stereotyping and attitudes are reported as the most significant factors faced by people with disabilities in these fields.

At the precollege level students with disabilities are often discouraged from taking math and science courses and, when enrolled, are often not fully included in rigorous work in these classes. Poor high school preparation limits their options in college and careers.

To improve opportunities for students with disabilities in science, mathematics, technology, and engineering, DO-IT has launched a variety of programs that increase the number of disabled students pursuing these fields at the high school and college levels. The DO-IT MATH-SCI project works with high school math and science teachers to help them fully include students with disabilities in their classes. DO-IT stands for Disabilities, Opportunities, Internetworking, and Technology. MATH-SCI stands for Making Accommodations that Help Schools Create Inclusion.

Access or Attitude?

One of the greatest difficulties facing people with disabilities is created when their capacity to be educated and function in the world is evaluated solely by limitations imposed by their disabilities. They essentially become defined by their disabilities, rather than their broad range of interests and abilities. For example, many people who sustain spinal cord injuries are encouraged to participate in wheelchair basketball after they leave rehabilitation facilities. This may be fine for some people. But, for those who have never had an interest in playing basketball before, why should they become basketball players now? In an example like this people are making assumptions about ability based solely upon the characteristics of a person's disability.

Another assumption is that a disability limits an individual in every aspect of his or her functioning, including the ability to be educated. To meet the intent of the Americans with Disabilities Act (ADA), educators must develop an attitude that is disability-positive. Students with disabilities can work hard and be productive and should be expected to do so.

Accommodations are Unique to the Individual

Conversations about disabilities in an educational setting are quickly dominated by the one-size-fits-all syndrome. Whether we are talking about a person who has a physical, sensory, learning, or cognitive disability, we like to have simple solutions that fit all. In truth, students with disabilities have the same variety of needs and preferences as anyone else. Although the energy and construction costs of every business could be cut dramatically by simply lowering all of the interior ceilings to a maximum height of 52 inches and this solution would work very well for many people who use wheelchairs or are of short stature, others might grumble when they have to maneuver on their knees as they move around the office. This kind of narrowly focused, inadequate, uniform solution is often imposed on the student with a disability, creating an educational environment that is counterproductive.

Where To Go From Here?

The MATH-SCI project has developed a model process and a Student Activities Profile form for creating effective accommodations in science and math classes. It can be used by any teacher and is composed of the following four steps:

Step #1: What does the task or assignment require?

Break down all of the components of the experiment, assignment, or exercise. As an educator, you are usually focused on the overall outcome of the project. To accommodate a student with a disability it's important to think about the specific settings, tools, skills, and tasks that are required at each step. By analyzing and evaluating the task thoroughly you will be able to determine how best to fully and effectively include a student with a specific disability.

Step #2: What physical, sensory, and cognitive skills are needed?

Match the tasks required to the physical, sensory, and cognitive skills needed to successfully complete the project. It is easy to say, "If I had a physical, sensory, or cognitive disability I would not be able to complete this assignment," without really determining what skills are needed for specific aspects of the project. We need to separate the "real" requirements of a specific task from the "fictional or perceived" requirements of the project in total. It is impossible to place yourself in the shoes of the student with a disability. He/she may have learned many ways to solve a specific problem or task and work around the limitations imposed by the disability.

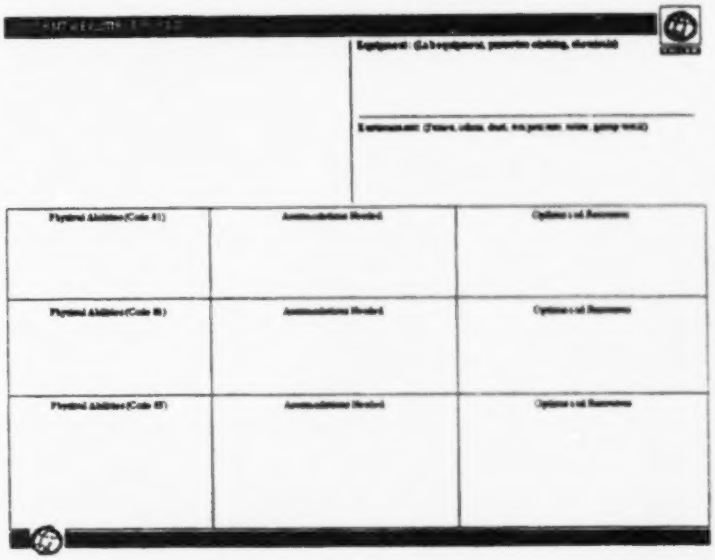
Step #3: What components of the task require accommodation?

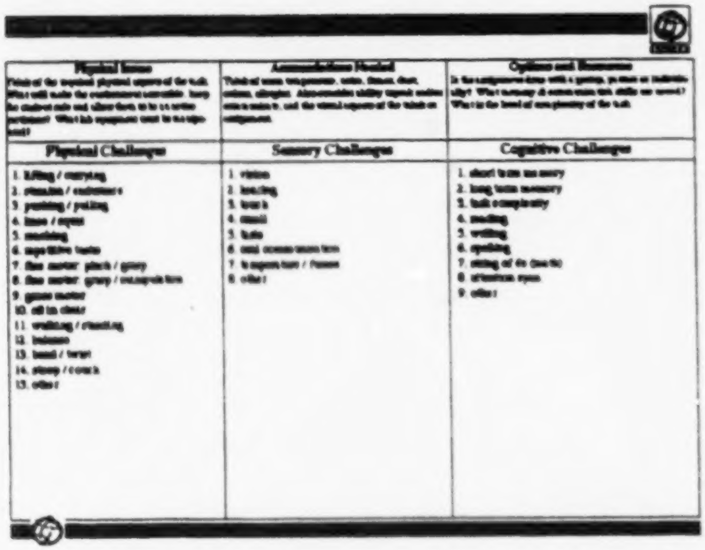
Once the task has been analyzed and the skills needed are identified, determine what accommodations may be required or how the learning experience might be altered to make it more accessible. Determine the level of difficulty of the project and determine how best to make an accommodation to create an inclusive environment for a student with a disability. It is very important to consult with the student to determine what they perceive as aspects of a project which they may need an accommodation or assistance.

Step #4: What accommodation options exist?

Now that the tasks that need accommodation have been determined, identify what resources exist for providing the needed accommodation(s). The student may have some good ideas, however, this is a time when other staff and professionals may have expertise in specific areas and be called on to provide input. In some cases, having students work in groups where each person is assigned a task that they have the ability to complete provides a reasonable alternative.

Following is the Student Abilities Profile form designed to guide you in determining a student's skills and abilities as well as assisting you in breaking down the individual components of a science or mathematics assignment. The form asks you to briefly describe the student, the classroom or laboratory environment, equipment or supplies needed, available professional and external resources, possible effective accommodations and the physical, sensory, and cognitive skills needed for the task.





Full size profile forms and accompanying videotape and resource materials are included in the product *Accommodating Students with Disabilities in Math and Science: A RESOURCE FOR TEACHERS*. Contact DO-IT for ordering and pricing information.

BEST COPY AVAILABLE

Resources

- To accompany this handout DO-IT MATH-SCI has created a videotape. This 15-minute videotape, *The Winning Equation: Access + Attitude = Success in Math and Science*, which teaches strategies for fully including students with disabilities in science and math, may be ordered by sending a check for $20 to DO-IT.

- DO-IT MATH-SCI has created comprehensive program development materials titled *Accommodating Students with Disabilities in Math and Science: A RESOURCE FOR TEACHERS*. Send a check for $60 to DO-IT to order this product.

- For information resources related to DO-IT, disabilities, adaptive technology, science, engineering, mathematics, and post-secondary education, access DO-IT's World Wide Web home page. DO-IT's printed publications are also available at this site: *http://www.washington.edu/doit/*

- To discuss issues pertaining to individuals with disabilities and their pursuit of science, engineering, and mathematics academic programs and careers, subscribe to the doitsem LISTPROC discussion list by sending electronic mail to *listproc@u.washington.edu*. In the message text type "subscribe doitsem" followed by your full name.

- To contact staff, request electronic copies of DO-IT NEWS, request publications or ask questions about the program, send electronic mail to *doit@u.washington.edu*

About DO-IT

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